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A Study of Mandatory Engine Maintenance for Reducing Vehicle Exhaust Emissions

Vol. 4 experimental characterization of vehicle emissions and maintenance states

TRW Systems Group

prepared for

Environmental Protection Agency

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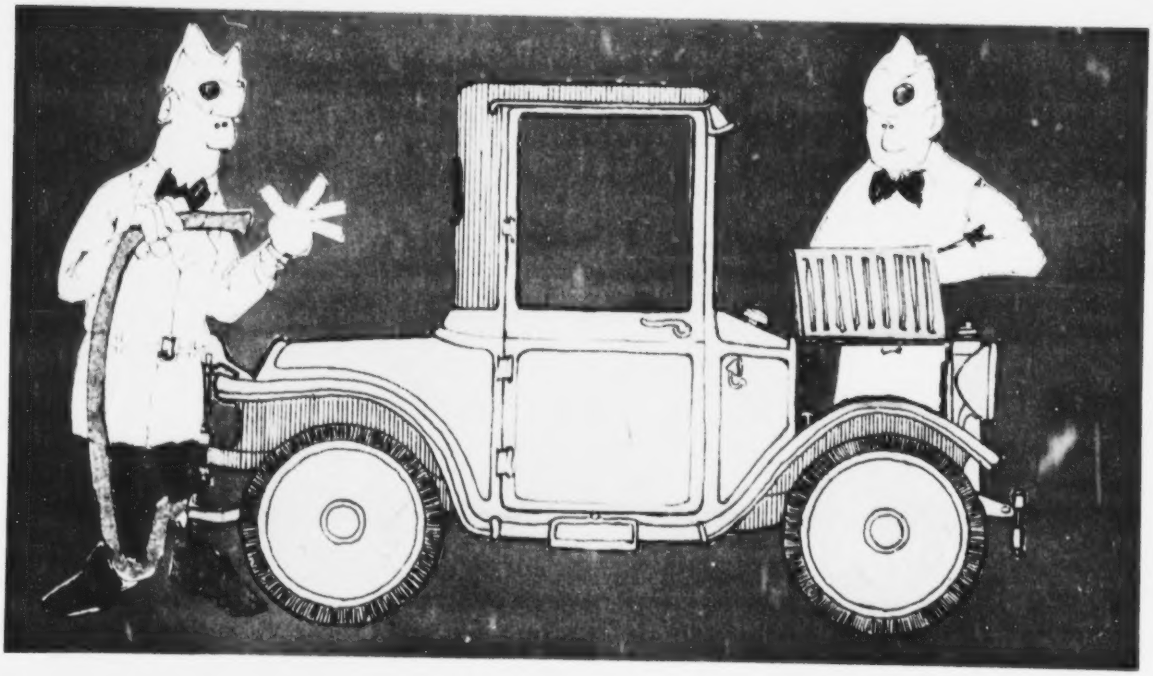

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The Economic Effectiveness Model is a tool by which any state, air basin, or region can determine the most effective vehicle maintenance and inspection program to reduce vehicle exhaust emission contributions to air pollution. Three distinct experimental programs were conducted to characterize vehicle emissions and maintenance states: (1) A large scale fleet evaluation to determine vehicle engine parameter setting distributions and component deterioration characteristics with time and mileage; (2) Statistically designed test (orthogonal experiemtns) of 1971 California and pre-emission controlled vehicles to determine the main effects and first order interactions of emission response to engine parameters; and (3) a survey to determine the maintenance condition (state of tune-up) of vehicle engine tune-up parameters and emission control systems and components of vehicles in the Detroit area. The designs and results of each of these experiments are discussed

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PREFACE

This report, "A Study of Mandatory Engine Maintenance for Reducing Vehicle Exhaust Emissions," consists of five volumes. The following are the subtitles given for each volume:

- Executive Summary, Volume I
- Mandatory Inspection/Maintenance Systems Study, Volume II
- A Documentation Handbook for the Economic Effectiveness Model, Volume III
- Experimental Characterization of Vehicle Emissions and Maintenance States, Volume IV
- Experimental Characterization of Service Organization Maintenance Performance, Volume V

The first volume summarizes the general objectives, approach and results of the study. The second volume presents the results of the mandatory inspection/maintenance system study conducted with a computerized system model which is described in Volume III. The experimental programs conducted to develop input data for the model are described in Volume IV (Interim Report of 1971-72 Test Effort) and V.

The work presented herein is the product of a joint effort by TRW Systems Group and its subcontractor, Scott Research Laboratories. TRW, as the prime contractor, was responsible for overall program management, experimental design, data management and analysis, and the economic effectiveness study. Scott acquired and tested all of the study vehicles. Scott also provided technical assistance in selecting emission test procedures and in evaluating the test results.

TABLE OF CONTENTS

Page

1.0 INTRODUCTION AND SUMMARY 1-1
2.0 ENGINE PARAMETER DETERIORATION STUDY 2-1
  2.1 VEHICLE SAMPLE IDENTIFICATION AND ACQUISITION PROCEDURES . 2-2
    2.1.1 Fleet Acquisition 2-2
    2.1.2 Fleet Identification and Description 2-3
    2.1.3 Vehicle Scheduling and Control 2-5
  2.2 VEHICLE INSPECTION AND TUNE-UP PROCEDURES 2-13
    2.2.1 Inspection Procedures 2-13
    2.2.2 Initialization Maintenance Procedures 2-20
    2.2.3 Unscheduled Maintenance and Repairs 2-22
  2.3 EXHAUST EMISSION TESTS. 2-23
    2.3.1 Exhaust Emission Test Procedures 2-23
    2.3.2 Exhaust Emission Test Cycles 2-27
  2.4 INSTRUMENTATION AND TEST EQUIPMENT 2-31
    2.4.1 Engine Parameter Inspection Equipment 2-31
    2.4.2 Emission Test Equipment. 2-32
    2.4.3 Instrument Maintenance and Calibration 2-34
  2.5 DATA REDUCTION PROCEDURES 2-34
    2.5.1 Data Reduction and Analysis System 2-34
    2.5.2 Description of Computer Programs 2-37
    2.5.3 Data Processing System 2-45
  2.6 PRELIMINARY RESULTS 2-47
    2.6.1 Population Attributes. 2-47
    2.6.2 Maintenance Effects on Emissions and Engine Parameters 2-72
    2.6.3 Emission Signatures Diagnostic Content 2-82
    2.6.4 Emission and Engine Parameter Deterioration. 2-115
    2.6.5 Misfire. 2-122
    2.6.6 Investigation of Differences in Idle CO Measurements by Two Procedures. 2-127
    2.6.7 Oxides of Nitrogen Measurement Systems 2-131
3.0 ORTHOGONAL EXPERIMENTS 3-1
  3.1 EXPERIMENTAL DESIGN 3-2
    3.1.1 Selection of Test Parameters 3-2
    3.1.2 Test Vehicle Selection 3-3

TABLE OF CONTENTS (CONT'D)

Page

3.1.3 Orthogonal Experimental Design 3-8
3.1.4 Data Reduction Procedure 3-11
3.1.5 Data Analysis Procedure. 3-11
3.2 TEST PROCEDURES 3-14
3.2.1 Vehicle Preparation. 3-14
3.2.2 Exhaust Emission and Test Cycles 3-16
3.2.3 Experimental Procedures and Controls 3-17
3.3 INSTRUMENTATION AND TEST EQUIPMENT. 3-21
3.4 DATA REDUCTION PROCEDURES 3-21
3.5 TEST RESULTS AND CONCLUSIONS--HOT ENGINE PARAMETERS 3-21
3.5.1 Timing Maladjustment 3-23
3.5.2 Idle Speed Maladjustment 3-36
3.5.3 Idle Fuel-to-Air Maladjustment 3-37
3.5.4 Air Cleaner Restriction. 3-38
3.5.5 Positive Crankcase Ventilation (PCV) Restriction . . 3-40
3.5.6 NO_x Spark Retard System. 3-41
3.5.7 Influences of Other Operating Modes. 3-41
3.5.8 Experimental Error 3-45
3.6 TEST RESULTS AND CONCLUSIONS--COLD START PARAMETERS 3-54
3.6.1 Analysis Approach. 3-54
3.6.2 Discussion of Results. 3-58
4.0 DETROIT ENGINE PARAMETER SURVEY. 4-1
4.1 EXHAUST SAMPLE IDENTIFICATION AND ACQUISITION PROCEDURES. . 4-1
4.1.1 Vehicle Sample Identification. 4-1
4.1.2 Vehicle Acquisition. 4-2
4.2 VEHICLE INSPECTION AND EMISSION TEST PROCEDURES 4-7
4.2.1 Engine Parameter Inspection. 4-7
4.2.2 Emission Inspection. 4-7
4.3 INSTRUMENTATION AND TEST EQUIPMENT. 4-7
4.4 DATA ANALYSIS AND TEST RESULTS. 4-8
4.5 REGIONAL COMPARISON OF VEHICLE EMISSIONS AND ENGINE PARAMETERS. 4-31
APPENDIX A. A-1
APPENDIX B. B-1
APPENDIX C. C-1

LIST OF FIGURES

Figure	Title	Page
2.1	Test Vehicle Processing Sequence	2-6
2.2	Vehicle Inspection Form	2-7
2.3	Vehicle Control Log	2-8
2.4	Engine Parameter Inspection	2-9
2.5	Vehicle Identification Sheet	2-11
2.6	Engine Analyzer Ignition Pattern	2-14
2.7	Engine Parameter Adjustment/Repair Record	2-24
2.8	Procedure for Repairing Fleet Test Vehicles	2-25
2.9	Federal Short Cycle Driving Schedule	2-28
2.10	Short Diagnostic Cycles	2-29
2.11	Data Reduction and Analysis System	2-35
2.12	Computer Program Interfaces	2-38
2.13	Data Processing System	2-46
2.14	Fleet 1 Make 8 Cyl Auto Trans	2-48
2.15	Fleet 2 Make 8 Cyl Auto Trans	2-49
2.16	Fleet 3 Make 8 Cyl Auto Trans	2-50
2.17	Fleet 1 HC 72 Fed Cold	2-52
2.18	Fleet 1 CO 72 Fed Cold	2-53
2.19	Fleet 1 NOX 72 Fed Cold	2-54
2.20	Fleet 2 HC 72 Fed Cold	2-55
2.21	Fleet 2 CO 72 Fed Cold	2-56
2.22	Fleet 2 NOX 72 Fed Cold	2-57
2.23	Fleet 3 HC 72 Fed Cold	2-58
2.24	Fleet 3 CO 72 Fed Cold	2-59
2.25	Fleet 3 NOX 72 Fed Cold	2-60
2.26	Fleet 1 Test 1A Timing Dv	2-63
2.27	Fleet 2 Test 1A Timing Dv	2-64
2.28	Fleet 3 Test 1A Timing Dv	2-65
2.29	Fleet 1 Test 1A IRPM Dv	2-66
2.30	Fleet 2 Test 1A IRPM Dv	2-67
2.31	Fleet 3 Test 1A IRPM Dv	2-68
2.32	Fleet 1 Test 1A Air Cleaner Angle MS	2-69
2.33	Fleet 2 Test 1A Air Cleaner Angle MS	2-70

LIST OF FIGURES (CONT'D)

Figure	Title	Page
2.34	Fleet 3 Test 1A Air Cleaner Angle MS	2-71
2.35	Fleet 1 Test 1A PCV Flow 49/45 MPH	2-73
2.36	Fleet 2 Test 1A PCV Flow 49/45 MPH	2-74
2.37	Fleet 3 Test 1A PCV Flow 49/45 MPH	2-75
2.38	Fleet 1 Test 1A Choke Kick DV	2-76
2.39	Fleet 2 Test 1A Choke Kick DV	2-77
2.40	Fleet 3 Test 1A Choke Kick DV	2-78
2.41	Data Analysis Support of Economic Effectiveness Model	2-84
2.42	Fleet 1 1A Timing DV LO - Cutpount HCD3	2-87
2.43	Fleet 1 1A Timing DV MID - Cutpoint HCD3	2-88
2.44	Fleet 1 1A Timing DV HI - Cutpoint HCD3	2-89
2.45	Analysis of Emission Signature Cutpoint - Timing	2-108
2.46	Analysis of Emission Signature Cutpoint - IDLE RPM	2-109
2.47	Analysis of Emission Signature Cutpoint - PCV Flow	2-110
2.48	Analysis of Emission Signature Cutpoint - Air Cleaner	2-111
2.49	Analysis of Emission Signature Cutpoint - Air Pump	2-112
2.50	Linear Regression of Chemiluminescence and NDIR/NDUV NOX Measurements (1972 Federal CVS Procedure)	2-135
2.51	Linear Regression of Chemiluminescence and NDIR/NDUV NOX Measurements (Federal Short Procedure)	2-136
2.52	Linear Regression of Chemiluminescence and NDIR/NDUV NOX Measurements (49/45 MPH Cruise Mode)	2-137
2.53	Linear Regression of Chemiluminescence and NDIR/NDUV NOX Measurements (33/30 MPH Cruise Mode)	2-138
2.54	Linear Regression of Chemiluminescence and NDIR/NDUV NOX Measurements (Idle Mode)	2-139
2.55	Variation of Dual Instrument System Bias Error with Absolute Value of NOX (Federal Short Cycle)	2-141
2.56	Variation of Dual Instrument System Bias Error with Absolute Value of NOX (1972 Federal CVS Procedure)	2-142
2.57	Variation of Normalized Dual Instrument Data with Absolute Value of NOX (1972 Federal Test Procedure)	2-143
2.58	Variation of Normalized Dual Instrument Data with Absolute Value of NOX (EPA Short Cycle)	2-144
2.59	Variation of Normalized Dual Instrument Data with Time (1972 Federal CVS Procedure)	2-146
2.60	Variation of Normalized Dual Instrument Data with Time (Federal Short Cycle)	2-147

LIST OF FIGURES (CONT'D)

Figure	Title	Page
3.1	Form 1.1 - Vehicle Control Log	3-19
3.2	Engine Parameter Deviation Check Sheet	3-22
4.1	Detroit 60-67 Make 8 Cyl Auto Trans	4-5
4.2	Detroit 68-71 Make 8 Cyl Auto Trans	4-6
4.3	Detroit Fleet 1 HCD1	4-9
4.4	Detroit Fleet 1 HCD2	4-10
4.5	Detroit Fleet 1 HCD3	4-11
4.6	Detroit Fleet 2 HCD1	4-12
4.7	Detroit Fleet 2 HCD2	4-13
4.8	Detroit Fleet 2 HCD3	4-14
4.9	Detroit Fleet 1 COD1	4-15
4.10	Detroit Fleet 1 COD2	4-16
4.11	Detroit Fleet 1 COD3	4-17
4.12	Detroit Fleet 2 COD1	4-18
4.13	Detroit Fleet 2 COD2	4-19
4.14	Detroit Fleet 2 COD3	4-20
4.15	Detroit Fleet 1 IRPM DV	4-21
4.16	Detroit Fleet 2 IRPM DV	4-22
4.17	Detroit Fleet 1 Timing DV	4-23
4.18	Detroit Fleet 2 Timing DV	4-24
4.19	Detroit Fleet 1 PCV 49/45 MPH Cruise	4-25
4.20	Detroit Fleet 2 PCV 49/45 MPH Cruise	4-26
4.21	Detroit Fleet 1 Air Cleaner Angle	4-27
4.22	Detroit Fleet 2 Air Cleaner Angle	4-28
4.23	Detroit 1 Choke Kick DV	4-29
4.24	Detroit 2 Choke Kick DV	4-30

LIST OF TABLES

Table	Title	Page
2.1	Percent of Vehicle Population by Make and Number Required for Each Emission Control Fleet	2-4
2.2	Crankcase Ventilation System Types	2-12
2.3	Idle CO % Specifications	2-21
2.4	Key Mode Cycles	2-30
2.5	Definition of Parameter Deterioration and Parking Lot Survey Data Storage File Record	2-40
2.6	Comparison of San Bernardino and Detroit as Received Emission and Engine Parameter Distributions	2-61
2.7	As Received Vehicle Parameters and Their Change with Maintenance	2-79
2.8	Effect of Idle Emission Inspection Prior to Maintenance	2-82
2.9	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Low Cutpoint)	2-90
2.10	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Mid Cutpoint)	2-91
2.11	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (High Cutpoint)	2-92
2.12	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) Low Cutpoint	2-93
2.13	Summary of Distributions Parititoned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) Mid Cutpoint	2-94
2.14	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) High Cutpoint	2-95
2.15	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (NOX Controlled Vehicles) Low Cutpoint	2-96
2.16	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (NOX Controlled Vehicles) Mid Cutpoint	2-97
2.17	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (NOX Controlled Vehicles) High Cutpoint	2-98
2.18	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Pre-Emission Controlled Vehicles) Low Cutpoint	2-99
2.19	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Pre-Emission Controlled Vehicles) Mid Cutpoint	2-100

LIST OF TABLES (CONT'D)

Table	Title	Page
2.20	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Pre-Emission Controlled Vehicles) High Cutpoint	2-101
2.21	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) Low Cutpoint	2-102
2.22	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) Mid Cutpoint	2-103
2.23	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (Emission Controlled Vehicles) High Cutpoint	2-104
2.24	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (San Bernardino Vehicle Fleet) Low Cutpoint	2-105
2.25	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (San Bernardino Vehicle Fleet) Mid Cutpoint	2-106
2.26	Summary of Distributions Partitioned by Applying Diagnostic Cycle Cutpoints (San Bernardino Vehicle Fleet) High Cutpoint	2-107
2.27	Change in Parameter from Tune Condition Over Four Months of Fleet Operation (First Test Period - Test 2)	2-117
2.28	Estimated Deterioration Rates	2-121
2.29	Analysis of Spark Plug Misfire	2-123
2.30	Summary of Misfire of Vehicles Prior to Engine Tune Scope vs. Key Mode HC Emissions (Test 1A)	2-126
2.31	Direct Comparison of Instruments Used to Measure CO	2-128
2.32	Comparison of NOX Data from NDIR/UV and Chemiluminescence Instruments	2-133
2.33	Linear Relationship of Chemiluminescence and NDIR/NDUV Measurements of NOX	2-134
2.34	Influence of Procedures on NOX Instrument System Performance	2-148
3.1	Orthogonal Test Proposed Pre-Emission Controlled Vehicles	3-4
3.2	Description of Pre-Emission Control Vehicles Tested in the Orthogonal Experiment	3-5
3.3	Orthogonal Test Prospect NOX (1971) Controlled Vehicle Fleet	3-6
3.4	Description of NOX Controlled Vehicles Tested in the Orthogonal Experiment	3-7

LIST OF TABLES (CONT'D)

Table	Title	Page
3.5	Malfunction Settings for Pre-Emission Control Vehicles	3-9
3.6	Malfunction Settings for NOX Controlled Vehicles	3-10
3.7	Malfunction Settings for NOX Controlled Vehicles	3-12
3.8	Malfunction Settings for Ford Vehicles	3-13
3.9	Orthogonal Test Inspection and Tune-Up Procedures	3-15
3.10	72 Federal Hot Emission Responses to Timing (Pre-Emission Controlled Vehicles)	3-24
3.11	72 Federal Hot Emission Responses to Timing (1971 NOX Controlled Vehicles)	3-25
3.12	72 Federal Hot Emission Responses to IRPM (Pre-Emission Controlled Vehicles)	3-26
3.13	72 Federal Hot Emission Responses to IRPM (1971 NOX Controlled Vehicles)	3-27
3.14	72 Federal Hot Emission Response to IDLE CO (Pre-Emission Controlled Vehicles)	3-28
3.15	72 Federal Hot Emission Response to IDLE CO (Pre-Emission Controlled Vehicles)	3-29
3.16	72 Federal Hot Emission Response to IDLE CO (1971 NOX Controlled Vehicles)	3-30
3.17	72 Federal Hot Emission Response to Air Cleaner Restriction (Pre-Emission Controlled Vehicles)	3-31
3.18	72 Federal Hot Emission Response to Air Cleaner Restriction (1971 NOX Controlled Vehicles)	3-32
3.19	72 Federal Hot Emission Response to PCV Restriction (Pre-Emission Controlled Vehicles)	3-33
3.20	1972 Federal Hot Response Coefficients to PCV Restriction (1971 NOX Controlled Vehicles)	3-34
3.21	1972 Federal Hot Response Coefficients to Failure of the NOX Control (1971 NOX Controlled Vehicles)	3-35
3.22	Emission Response to Engine Parameters in Two Constant Speed Operating Modes	3-43
3.23	Comparison of Emission Response in Two Driving Cycles	3-46
3.24	Summary of Vehicles with Statistically Significant Differences in Variances	3-48
3.25	Repeatability of Orthogonal Experiment Results with Like Power Trains (1971 Chevrolet - HC Hot 1972 Federal CVS Procedure)	3-51
3.26	Repeatability of Orthogonal Experiment Results with Like Power Trains (1971 Chevrolet - CO Hot 1972 Federal CVS Procedure)	3-52

LIST OF TABLES (CONT'D)

Table	Title	Page
3.27	Repeatability of Orthogonal Experiment Results with Like Power Trains (1971 Chevrolet - NOX Hot 1972 Federal CVS Procedure)	3-53
3.28	Results of Analysis of Variance Conducted by Vehicle Cold Start Parameters	3-55
3.29	Cold Start Parameter Raw Test Data	3-56
3.30	Cold Start Parameter Normalized Test Data	3-59
3.31	Cold Start Parameter Analysis of Variance Results	3-60
3.32	Summary of Vehicles with Statistically Similar Responses	3-62
3.33	Summary of Pooled HC Emission Response Coefficients Pre-Emission Controlled Vehicle Cold Start Parameter Tests	3-64
3.34	Summary of Pooled CO Emission Response Coefficients Pre-Emission Controlled Vehicle Cold Start Parameter Tests	3-65
3.35	Summary of Pooled NOX Emission Response Coefficients Pre-Emission Controlled Vehicle Cold Start Parameter Tests	3-66
3.36	Summary of Pooled HC Emission Response Coefficients NOX Controlled Vehicle Cold Start Parameter Tests	3-67
3.37	Summary of Pooled CO Emission Response Coefficients NOX Controlled Vehicle Cold Start Parameter Tests	3-68
3.38	Summary of Pooled NOX Emission Response Coefficients NOX Controlled Vehicle Cold Start Parameter Tests	3-69
4.1	Engine Parameter Survey	4-3
4.2	Comparison of San Bernardino and Detroit Vehicle Parameter Distributions	4-32
4.3	Comparison of San Bernardino and Detroit Vehicle Parameter Distributions	4-33

1.0 INTRODUCTION AND SUMMARY

Specific experiments were performed during the second year of the Vehicle Inspection and Maintenance program to further refine experimentally developed vehicle engine parameter and emission characteristics for use in the Economic Effectiveness Model. The Economic Effectiveness Model is a tool by which any state, air basin, or region can determine the most effective vehicle maintenance and inspection program to reduce vehicle exhaust emission contributions to air pollution.

Three distinct experimental programs were conducted to characterize vehicle emissions and maintenance states:

- A large scale fleet evaluation to determine vehicle engine parameter setting distributions and component deterioration characteristics with time and mileage
- Statistically designed tests (orthogonal experiments) of 1971 California and pre-emission controlled vehicles to determine the main effects and first order interactions of emission response to engine parameters
- A survey to determine the maintenance condition (state of tune-up) of vehicle engine tune-up parameters and emission control systems and components of vehicles in the Detroit area.

The designs and results of each of these experiments are discussed in the following sections:

2.0 - Engine Parameter Deterioration Study
3.0 - Orthogonal Experiments
4.0 - Detroit Engine Parameter Survey

2.0 ENGINE PARAMETER DETERIORATION STUDY

An experimental program was conducted to obtain engine tune-up state and the corresponding vehicle emissions of infield vehicles and deterioration of engine parameters and their resulting vehicle emission characteristics during use following initialization of the vehicles to manufacturers' specifications. The data were obtained by measuring engine operating parameters on privately owned and operated vehicle samples at four month intervals. Four hundred fifty (450) vehicles were initially obtained, inspected and emission tested prior to and following initialization of the vehicle, to manufacturers' specifications. The vehicles were subsequently recalled at scheduled four-month time intervals. All of the tests for first recall (416 vehicles) and half of the tests for the second recall (233 vehicles) were completed during the first year of the program. The attrition of this test vehicle fleet was less than originally estimated at the outset of the program.

The following measurements were made on each vehicle at the four-month intervals:

- Quantitative characterization of engine parameters and settings that were shown in Phase One of the CAPE-13-68 program to be significant in an emission control program.
- Exhaust emissions using the 1972 Federal Test Procedure and the Federal short cycle. During the eighth month of the program the 1972 Federal Test Procedure was replaced with the 1975 Procedure.
- Closed, hot seven-mode cycle CVS mass emissions, at the time of the first test.
- Concentration of exhaust emission levels at idle and under loaded engine conditions.

The total fleet was divided equally into three groups of 150 vehicles each according to their emission control equipment. The basic description of the fleets were pre-emission controlled vehicles, vehicles with emission control equipment prior to the 1971 model year and NO_x emission controlled vehicles sold in California during the 1971 model year.

In order to characterize deterioration of engine parameters with both time and mileage accumulation, it was necessary to establish a baseline from which deterioration could be monitored. This was accomplished by adjusting or replacing components in accordance to the manufacturer's specifications at the beginning of the deterioration surveillance period. The emission and engine diagnostic tests were made both before and after the initial tune-up.

2.1 VEHICLE SAMPLE IDENTIFICATION AND ACQUISITION PROCEDURES

2.1.1 Fleet Acquisition

Three fleets of 150 vehicles each were identified and acquired by Scott. Candidate vehicles were first selected from a file of Scott solicited questionnaires. Only the questionnaires from owners who indicated an interest in participating in an experimental program were considered. When vehicles were needed during the first four months of initial acquisition, the owners of acceptable vehicles were contacted, given an explanation of the program and the incentive provided and given a schedule for testing if they were willing to participate.

The owners of vehicles used in the program were always supplied with a 1971 loan vehicle while their car was retained by Scott. In addition, the first test maintenance was performed at no cost and a cash and gasoline incentive was given to the owners at each subsequent test. The cash incentive was $15 for 1971 model year vehicles and $10 for all prior model year vehicles. Each owner's vehicle received five gallons of premium grade gasoline upon completion of subsequent tests.

The vehicles that were supplied as loan vehicles were new, major manufacturer, 1971 intermediate size vehicles, equipped with standard V-8 engines and automatic transmissions. There were twenty of these loan vehicles and they were included in the California NO_x Controlled vehicle fleet.

2.1.2 Fleet Identification and Description

Vehicles included in the experimental program were limited to passenger vehicles and light duty trucks which were classified in one of three categories. Each category consisted of 150 vehicles at the initial implementation of the program (test phase 1). The specific classifications of each category were:

Fleet I - Vehicles with no exhaust emission controls (pre-emission controlled vehicles), which included 1960 through 1965 model year vehicles that were originally purchased in California and 1966 and 1967 model year vehicles that were originally purchased outside California. (The majority of vehicles were originally purchased in California and were equipped with Positive Crankcase Ventilation Systems.)

Fleet II - Vehicles equipped with exhaust emission controls (Emission Controlled vehicles), which included California vehicles from model years 1966 through 1970 and out-of-state vehicles from model years 1968 through 1970.

Fleet III - Vehicles originally sold in California for the 1971 model year (NO_x Controlled vehicles), which were required to meet NO_x emission standards.

Vehicles were obtained in proportion to the national in-use population, within the fleet groupings, as determined by vehicle registration data provided in the most recent Automotive News Almanac, Reference 1. The proportioning was based on vehicle make and within attainable goals; vehicle size, transmission type and number of engine cylinders. A description of the initial program goals for the distribution of makes within each fleet is presented in Table 2.1.

The distribution of vehicle makes was controlled for only U.S. makes and Volkswagens. All other foreign vehicles were combined into the miscellaneous cateogry. The percentage of foreign vehicles (Volkswagens included) was to be limited to 10 percent of Fleets I and II and to 20 percent of Fleet III. The number of vehicles was also approximately proportioned to in-use cars by model years within Fleets I and II. Deviations from the above criteria were required due to the low availability of 1960 through 1962 vehicles and American Motors Corporation and Oldsmobile vehicles for most years.

Table 2.1

Percent of Vehicle Population by Make and Number Required for Each Emission Control Fleet

Vehicle Make	Fleet #1 Uncontrolled		Fleet #2 Controlled		Fleet #3 1971 California	
	%	Number	%	Number	%	Number
Buick	5.6	9	6.1	11	5.8	10
Cadillac	2.0	4	2.1	4	1.9	3
Chevrolet	24.8	41	20.1	35	20.2	33
Chrysler	1.8	3	2.0	3	2.5	4
Dodge	4.8	8	5.6	10	6.3	10
Ford	19.8	33	18.3	31	22.8	37
Mercury	3.8	6	3.4	6	4.2	7
Oldsmobile	6.0	10	5.9	10	6.1	10
Plymouth	5.6	9	7.0	12	8.5	14
Pontiac	7.7	13	7.8	13	6.0	10
Rambler	4.2	7	2.6	4	3.3	5
Volkswagen	4.0	7	6.3	11	4.2	7
Miscellaneous	9.9	0	12.2	0	8.2	0
TOTAL	100	150	100	150	100	150

The ratio of automatic to manual transmissions was maintained, based on production statistics, for each fleet. The percentage of six cylinder and V-8 engines was maintained only across the entire 450 vehicles sample. The number of vehicles in Fleet II that were equipped with Air Injection emission control systems was limited to 20 percent of that fleet.

2.1.3 Vehicle Scheduling and Control

Vehicles were scheduled for testing on a continuous basis during the first four months of testing. Once these vehicles were obtained they were processed according to the Test Vehicle Processing Sequence illustrated in Figure 2.1. The specific details of the sequence elements are described as follows:

Sequence Element 1 - Owners were contacted as vehicles were required and appointments were made for delivery of the vehicles to the Scott facility. Each vehicle was inspected by Scott personnel to determine the condition of the body sheet metal, interior trim and mechanical performance. The completed Vehicle Inspection Form, Figure 2.2, was then signed by the owner. The exhaust system of the vehicle was leak checked by blocking the tail pipe outlet. Repairs were made if leaks were detected in the exhaust system.

Sequence Element 2 - Vehicle numbers were assigned on the following basis: Fleet I - 1 through 150, Fleet II - 151 through 300, and Fleet III - 301 through 450. A data package folder was placed in and remained with the vehicle during test and inspection. This folder was kept on file until the next time the vehicle was recalled for testing. The Vehicle Control Log, Figure 2.3, was included in the folder. The vehicle identification items 1.1 through 1.8 and scheduling information items 2.3 and 2.4 were filled out. The Engine Parameter Inspection Forms, Figure 2.4 (Section 2.2.1) were also included. All forms were identified with the vehicle and test numbers. The vehicle was then parked in a designated soak area. A Vehicle Identification Sheet, Figure 2.5, was placed in the vehicle to identify the vehicle and test number along with the data and starting time of the soak period.

Sequence Element 3 - While the vehicle was being soaked, the power train was identified by use of engine codes and carburetor list numbers. Items 1.9 through 1.14 of the Vehicle Control Log were completed. The crankcase emission system type was identified and codes as described in Table 2.2. The codes, 1 through 4, are consistent with the nomenclature used for California vehicle emission installation and inspection stations, Reference 2. The vehicle curb weight was

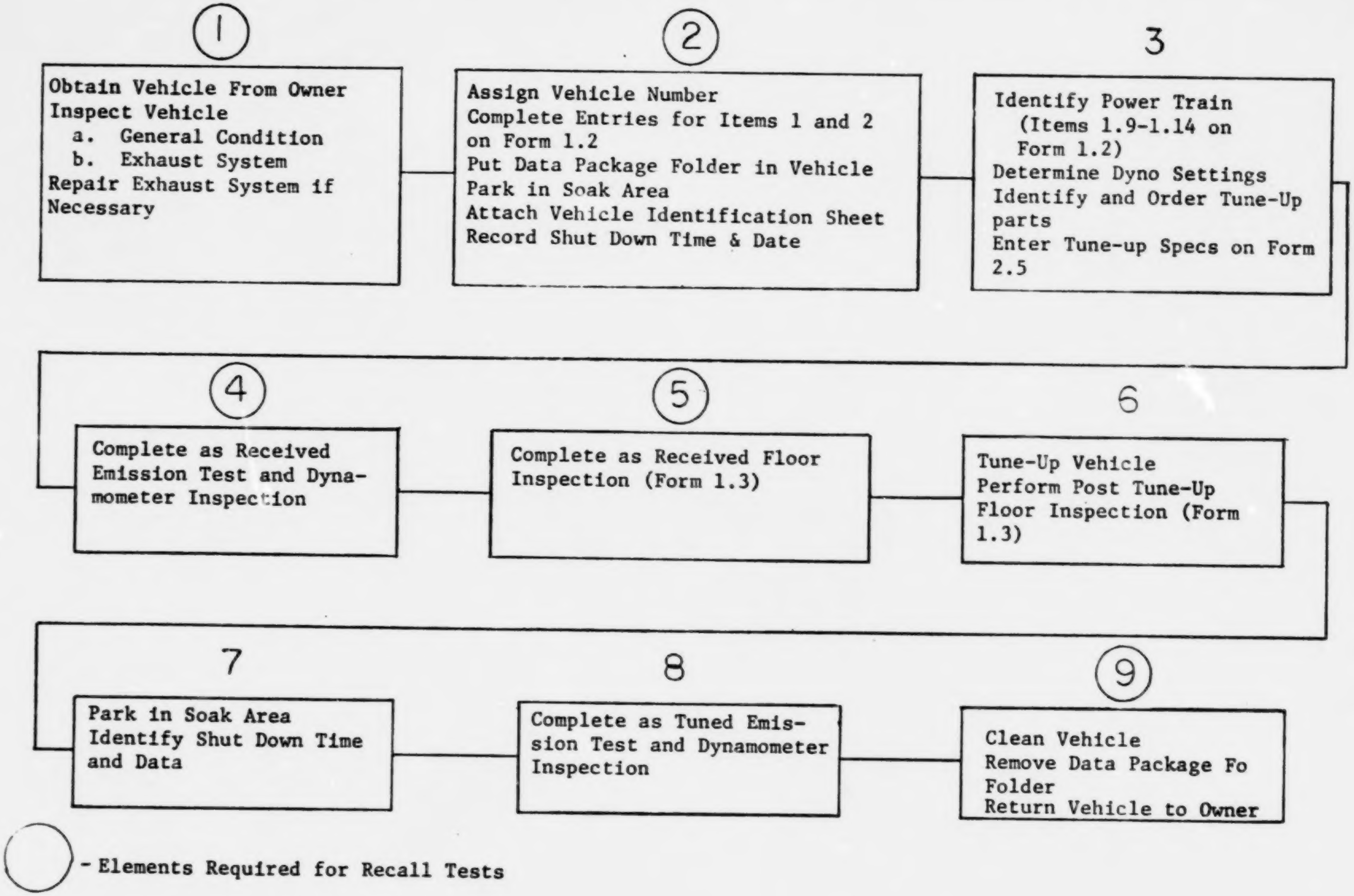

①
Obtain Vehicle From Owner
Inspect Vehicle
a. General Condition
b. Exhaust System
Repair Exhaust System if Necessary
②
Assign Vehicle Number
Complete Entries for Items 1 and 2 on Form 1.2
Put Data Package Folder in Vehicle
Park in Soak Area
Attach Vehicle Identification Sheet
Record Shut Down Time & Date
3
Identify Power Train
(Items 1.9-1.14 on Form 1.2)
Determine Dyno Settings
Identify and Order Tune-Up parts
Enter Tune-up Specs on Form 2.5
④
Complete as Received Emission Test and Dynamometer Inspection
⑤
Complete as Received Floor Inspection (Form 1.3)
6
Tune-Up Vehicle
Perform Post Tune-Up Floor Inspection (Form 1.3)
7
Park in Soak Area
Identify Shut Down Time and Data
8
Complete as Tuned Emission Test and Dynamometer Inspection
⑨
Clean Vehicle
Remove Data Package Fo Folder
Return Vehicle to Owner
○ - Elements Required for Recall Tests

Figure 2.1 Test Vehicle Processing Sequence

Vehicle Make____________________ No.__________________ Project No.________

Driver__________________________ License Plate No.________________________

Odometer, End____

Vehicle Condition at Start of Test:

Mechanical

__________Tires (incl. spare)

__________Headlights (incl. brights)

__________Tail-lights (incl. lic. plate)

__________Turn Signals

__________Brake Lights

__________Brake Pedal

__________Horn

__________Other

Body

__________Sheet Metal

__________Trim

__________Glass and Mirrors

__________Antenna

__________Wipers

__________Washers

__________Interior

__________Registration

__________Other

Performance

____________Engine

____________Transmission

____________Brakes

____________Steering

____________Starter

____________Noises

____________Air Cond.

____________Heater Blower

____________Other

Remarks:

____

____

____

____

____

____

____

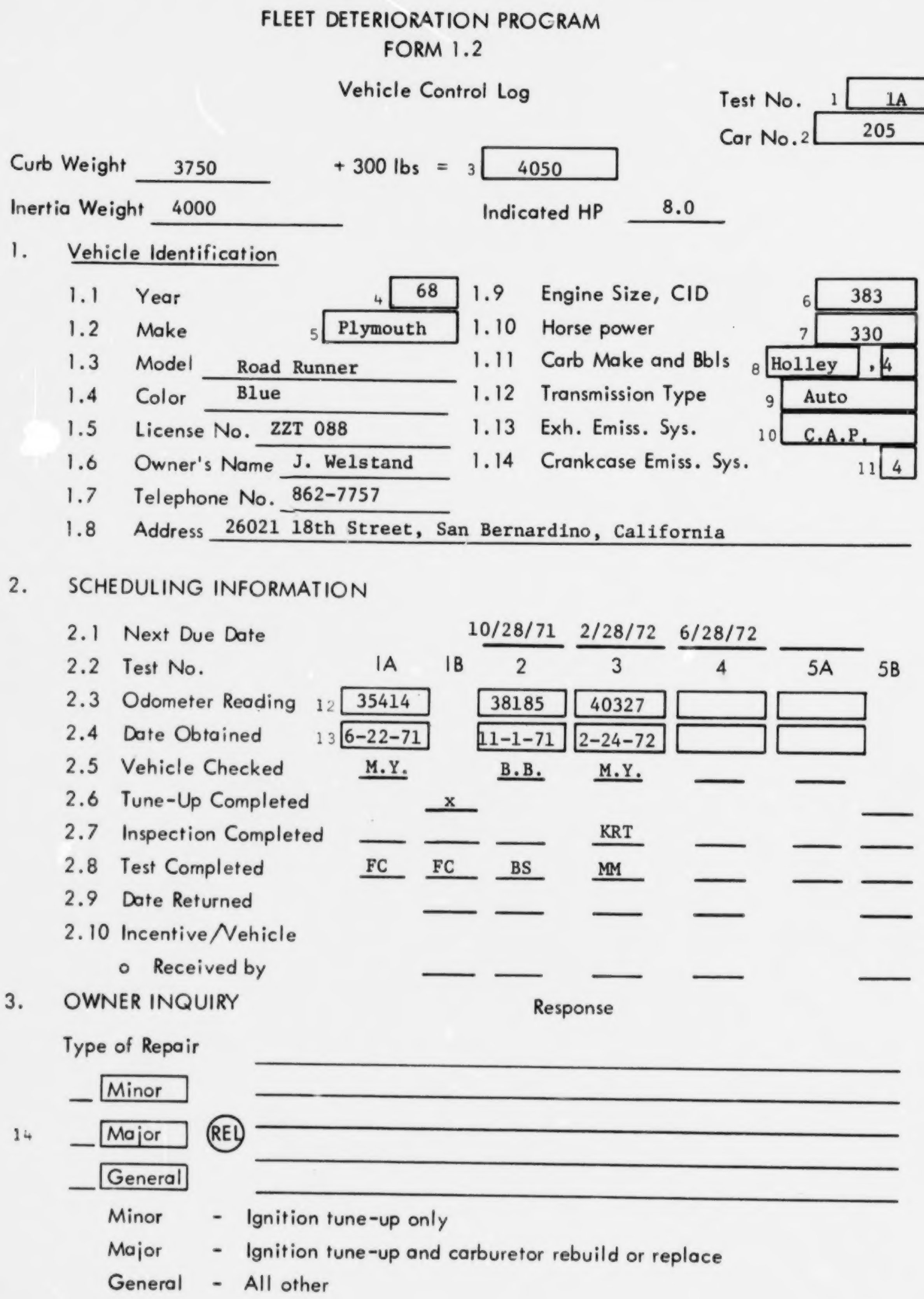
____

(Use back of sheet if necessary)

____

Signature:_________________________________ Date:____________________

Figure 2.2 Vehicle Inspection Form



FLEET DETERIORATION PROGRAM
FORM 1.2

Vehicle Control Log

Test No. 1 1A

Car No. 2 205

Curb Weight 3750 + 300 lbs = 3 4050

Inertia Weight 4000 Indicated HP 8.0

1. Vehicle Identification

1.1 Year 4 68

1.2 Make 5 Plymouth

1.3 Model Road Runner

1.4 Color Blue

1.5 License No. ZZT 088

1.6 Owner's Name J. Welstand

1.7 Telephone No. 862-7757

1.8 Address 26021 18th Street, San Bernardino, California

1.9 Engine Size, CID 6 383

1.10 Horse power 7 330

1.11 Carb Make and Bbls 8 Holley , 4

1.12 Transmission Type 9 Auto

1.13 Exh. Emiss. Sys. 10 C.A.P.

1.14 Crankcase Emiss. Sys. 11 4

2. SCHEDULING INFORMATION

2.1 Next Due Date				10/28/71	2/28/72	6/28/72		
2.2 Test No.		1A	1B	2	3	4	5A	5B
2.3 Odometer Reading	12	35414		38185	40327			
2.4 Date Obtained	13	6-22-71		11-1-71	2-24-72			
2.5 Vehicle Checked		M.Y.		B.B.	M.Y.			
2.6 Tune-Up Completed			x					
2.7 Inspection Completed					KRT			
2.8 Test Completed		FC	FC	BS	MM			
2.9 Date Returned								
2.10 Incentive/Vehicle								
o Received by								

3. OWNER INQUIRY

Response

Type of Repair

__ Minor

14 __ Major REL

__ General

Minor - Ignition tune-up only

Major - Ignition tune-up and carburetor rebuild or replace

General - All other

Figure 2.3 Vehicle Control Log

FLEET DETERIORATION PROGRAM
FORM 1.3

Engine Parameter Inspection
Performed By
SCOTT RESEARCH LABORATORIES, INC.

1. Vehicle Identification

1.1 Test No. 1 1A
1.2 Car No. 2 205
1.3 License No. ZZT 088
1.4 Inspected By JH
1.5 Date 6-24-71

			Measurement or Analysis			Manufacturer's Specification	
2.	Ignition System Inspection						
2.1	Required Voltage, kv at 1500 rpm	3	5-8	kv	4		kv
2.2	Coil Available Voltage, kv at 1500 rpm	5	36	kv	6		kv
2.3	Spark Line (OK, NG)	7	NG				
2.4	Coil Oscillations (OK, NG)	8	NG				
2.5	Point Opening Variation, degrees	9	2	°			
2.6	Coil Polarity (OK, NG)	10	OK				
2.7	Ignition Point Dwell, degrees	11	35	°	12	27-32	°
2.8	Condenser Oscillations (OK, NG)	13	OK				
2.9	Basic Ignition Timing, degrees	14	10 BTDC	°	15	5° BTDC	°
2.10	Total Advance at 2500 rpm, degrees	16	50	°	17	41-50 1/2	°
2.11	Mechanical Advance, at 2500 rpm, degrees	18	28	°	19	23-26 1/2	°
2.12	Vacuum Advance at 2500 rpm, degrees	20	22	°	21	18-24	°

REL

3.	Induction System						
3.1	Idle Speed, rpm (Chrys. in Neutral) N_ Dr_	1	650	rpm	2	600	rpm
3.2	Manifold Vacuum, in. Hg.	3	15	"	4		"
3.3	Air Cleaner Angle, degrees	5	0	°	6		°
3.4	Float Level, inches*	7		"	8		"
3.5	Choke, Vacuum Kick, inches	9	.081	"	10	.081	"
3.6	Choke Vacuum Diaphragm (OK, NG, None)	11	OK				
3.7	Heat Riser Valve (None, Free, Frozen)	12	FREE				

* On parking lot survey only

Figure 2.4 Engine Parameter Inspection

FLEET DETERIORATION PROGRAM

FORM 1.3 (Continued)

4. Emission Control

		Measurement or Analysis		Manufacturer's Specification
4.1 PCV Perf. at Idle, inches H_2O**	13	-.1	"	
4.2 Vacuum Leaks (Yes or No)	14	NO		
4.3 Idle rpm change (Leaks Eliminated)	15		rpm	
4.4 NO_x Control Device (Ok, NG, None)	16	NONE		
4.5 Timing Retard Mechanism (OK, NG, None)	17	NONE	REL	

5. Keymode Diagnostic Inspection

Dyno Load Set to 30 HP at 50 MPH

5.1 49/45 MPH Cruise

o Plug Req'd Volt, kv	1	7-9	kv	
o Misfire Rate, %	2	0	%	
o Air Cleaner Restriction, in H_2O	3	.2	"	
o PCV Flow, inches	4	.40	"	
o Air Pump Disconnected, Emissions		Completed By ________		

5.2 33.5/30 MPH Cruise

o Plug Req's Volt, kv	5	8-10	kv	
o Misfire Rate, %	6	0	%	
o Air Cleaner Restriction, in H_2O	7	.1	"	
o PCV Flow, inches	8	.40	"	
o Air Pump Disconnected, Emissions		Completed By ________		

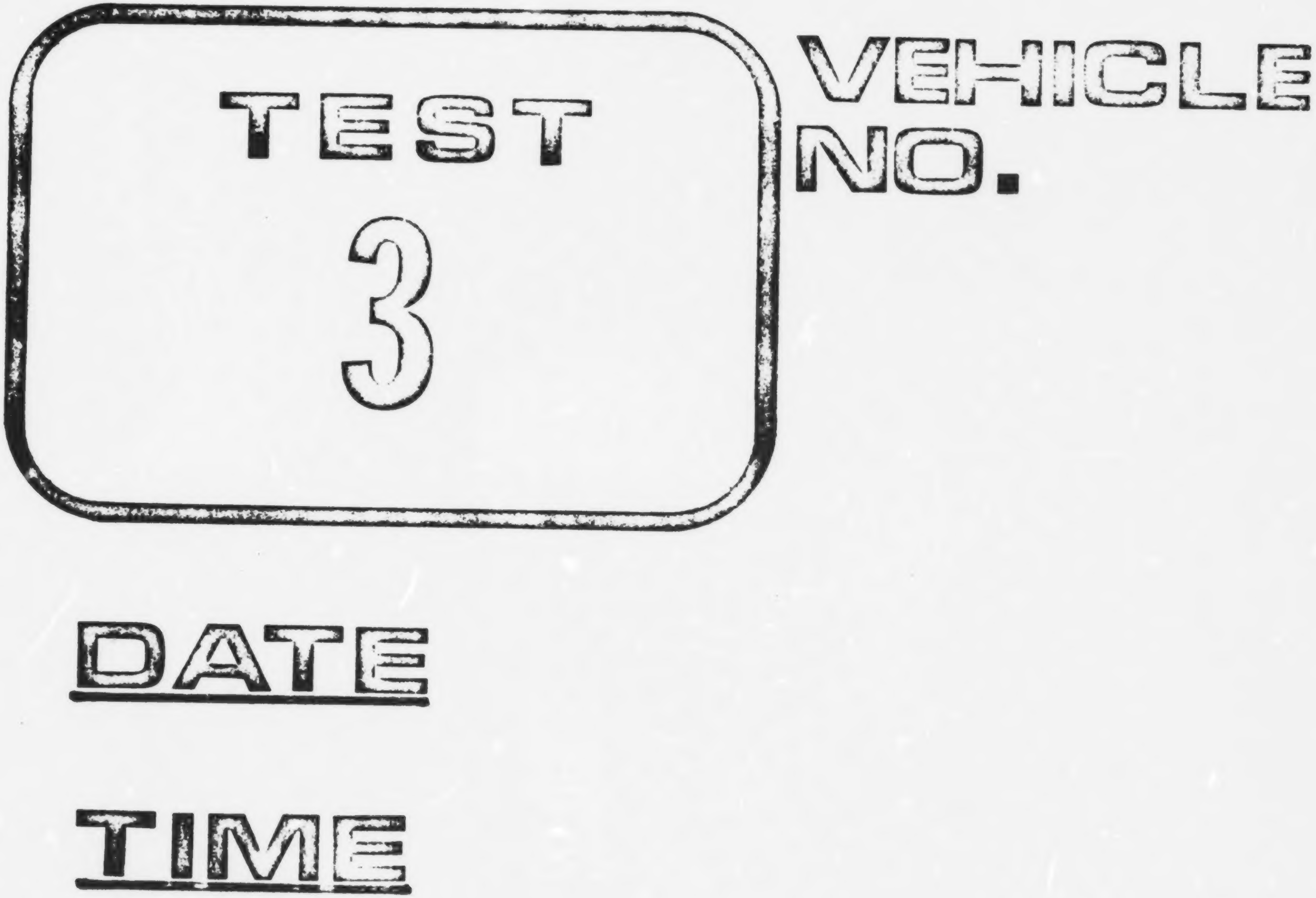
5.3 Idle (in Drive)

o Plug Req'd Volt, kv	9	12-15	kv	
o Misfire Rate, %	10	0	% REL	
o Air Pump Disconnected, Emissions		Completed By ________		

REMARKS: High point resistance

** Vacuum is minus (-), and Pressure is plus (+)

Figure 2.4 Engine Parameter Inspection (Continued)



TEST

3

VEHICLE
NO.

DATE

TIME

Figure 2.5 Vehicle Identification Sheet

Table 2.2

Crankcase Ventilation System Types

1. PCV Valve Only - Controlled By Manifold Vacuum (Open System)
2. Valve Only - Controlled by Crankcase Vacuum
3. Hose From Crankcase to Air Cleaner Only (Like VW)
4. Combination System - PCV Valve and Hose to Air Cleaner (Closed System)

determined from specifications listed in the Automotive News Almanac. The appropriate dynamometer inertia and indicated horsepower setting was then determined in accordance with the 1972 Federal Test Procedure. These settings were entered at the top of the Vehicle Control Log. The vehicle drive train description was used to identify and order the basic tune-up parts. The tune-up specifications were also determined and entered on the Engine Parameter Inspection Forms (Figure 2.4).

Sequence Elements 4, 5, 6, 7, and 8 - The required emission tests, parameter inspections, and tune-up were then performed in the sequence described in Figure 2.1. The details of these elements are fully described in Sections 2.2 and 2.3.

Sequence Element 9 - Upon completion of all required testing, the vehicle was washed, the data package folder was removed, and the owner was contacted to arrange for the return of the vehicle.

The first test sequence was designated as Test 1A and Test 1B for the "as-received" and "post tune-up" tests, respectively. The four-month recall tests were sequentially numbered Tests 2 and 3. The recall tests required only the element 1, 2, 4, 5, and 9 of the Test Vehicle Processing Sequence, Figure 2.1.

2.2 VEHICLE INSPECTION AND TUNE-UP PROCEDURES

2.2.1 Inspection Procedures

A comprehensive engine parameter adjustment and component inspection was performed in conjunction with each scheduled emission test. The engine inspection was designed to quantitatively evaluate those engine settings and components that affect vehicle exhaust emissions. The inspection covered the ignition system, induction system and emission control devices during a garage floor (stationary vehicle) evaluation. Measurements of ignition misfire, air cleaner blockage, PCV system performance and air injection pump system performance were made with the engine under load on the chassis dynamometer. Figure 2.4, Engine Parameter Inspection, was used to record all vehicle inspection information.

The procedures used for obtaining the measurements for the Engine Parameter Inspection form are outlined below in accordance to the numbering system as used on the Data Sheet, Figure 2.4. Figure 2.6 shows an acceptable ignition pattern and its nomenclature.

(2.) Ignition System Inspection

(2.1) Required Voltage

The parade display of the ignition scope is selected with the engine operating at 1500 rpm, no load. The minimum and maximum kilovolt sparkline readings are recorded.

(2.2) Coil Available Voltage

The same operating conditions as described in item 2.1 are employed, except one secondary ignition wire is disconnected for an open ignition circuit condition. The maximum kilovolt output that is observed for the open circuit cylinder is recorded.

(2.3) Spark Line

With the engine operating at 1500 rpm and the transmission set in neutral, the scope is set for stacked or raster display. The spark lines are rated OK if they are generally clean and level. Excessive slope or noise for any cylinder is rated NG (no good).

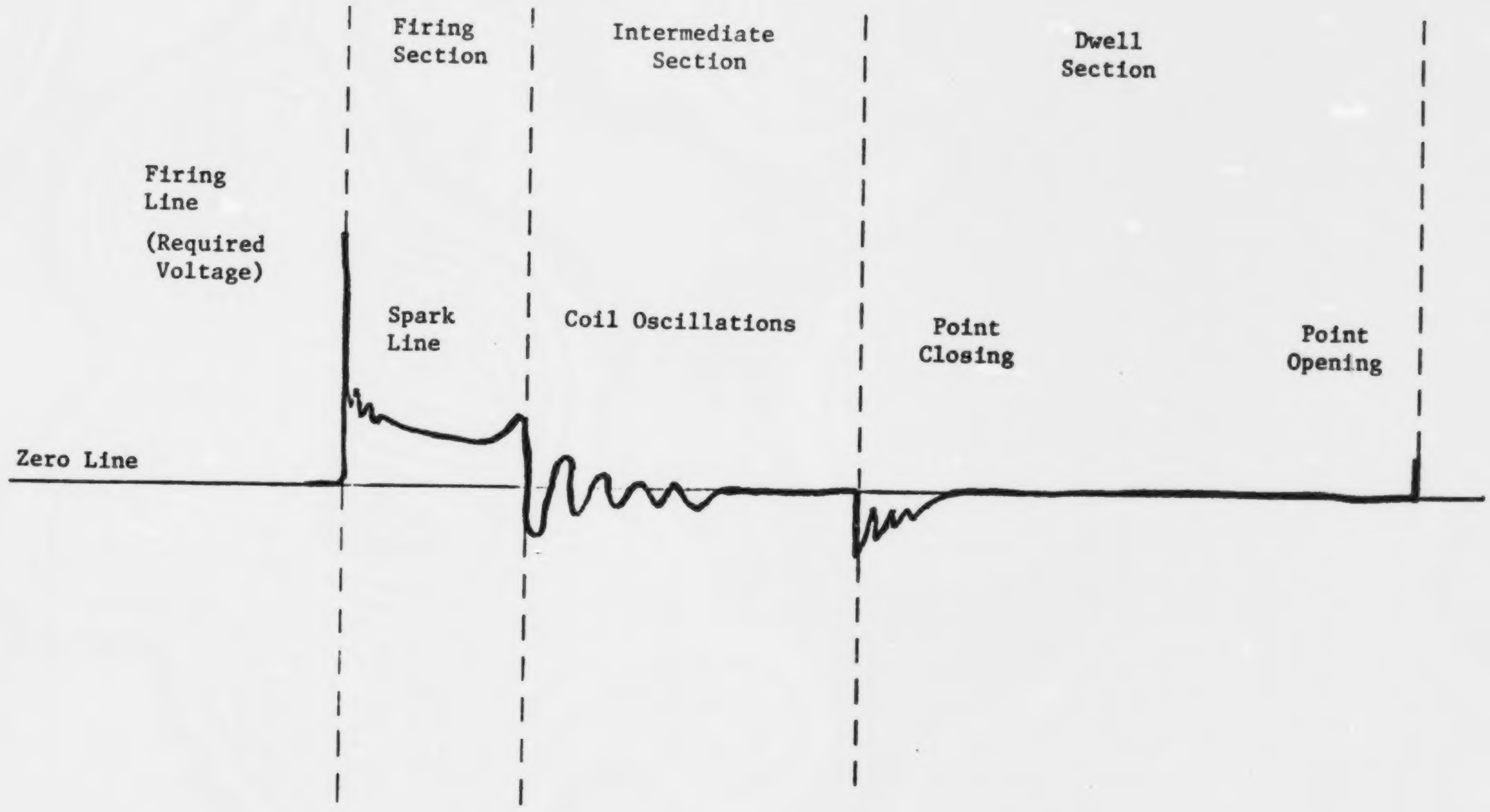

Firing Section
Intermediate Section
Dwell Section
Firing Line (Required Voltage)
Spark Line
Coil Oscillations
Point Closing
Point Opening
Zero Line

Figure 2.6 Engine Analyzer Ignition Pattern

(2.4) Coil Oscillations

Four or more oscillations are required for an OK rating. The ignition scope and engine rpm are set as described for item 2.3.

(2.5) Point Opening Variation

The engine is operated at idle and the scope is set for a superimposed display of cylinder ignition patterns. The difference in timing (point opening) between the cylinder with the earliest timing and the cylinder with the latest timing is recorded.

(2.6) Coil Polarity

If the ignition pattern is reversed on the vertical scale (upside-down), the polarity is reversed and rated NG.

(2.7) Ignition Point Dwell

The conventional (average point) dwell is recorded with the engine at idle.

(2.8) Condenser Oscillations

Oscillations must be observed and the first oscillation must have the greatest magnitude for an (OK) rating.

(2.9) Basic Ignition Timing

The distributor vacuum line is disconnected and the timing is recorded in accordance with the manufacturer's specifications.

(2.10) Total Advance at 2500 rpm

The engine is run at 2500 rpm in neutral and the total increase in ignition timing from the basic timing is recorded.

(2.11) Mechanical Advance at 2500 rpm

The same operating conditions as 2.10 are employed, except that the distributor vacuum line is disconnected. The increase in ignition timing from the basic timing is recorded.

(2.12) Vacuum Advance at 2500 rpm

The reading for 2.11 is subtracted from the reading for 2.10 to obtain the value for the vacuum advance.

(3.) Induction System

(3.1) Idle Speed

The idle rpm is measured with a tachometer according to the manufacturer's specifications.

(3.2) Manifold Vacuum

The manifold vacuum is obtained with the engine idling and the transmission set in neutral.

(3.3) Air Cleaner Angle

The vehicle's air cleaner element is placed on a commercial air cleaner tester and the relative restriction is indicated in angular degrees.

(3.4) Float Level

The float level was measured in the inspection of Detroit vehicles only and therefore was not a parameter measured on vehicles which were a part of the Deterioration Experiment. For those cases in which float level measurements were made (4.0 - Detroit Engine Parameter Survey), the float measurement was made in accordance to manufacturer's directions.

(3.5) Choke Vacuum Kick

The choke vacuum kick is measured according to the manufacturer's procedure with a spark plug gauge. Variouc nomenclatures for this setting are Vacuum Kick, Vacuum Break, Choke Plate or Valve Pulldown, Choke Opening, Choke Vacuum Piston, Intermediate Choke Rod and Initial Choke Opening.

(4.5) Timing Retard Mechanism

Such items as dual diaphragm distributors and solenoid operated retard mechanisms are evaluated for proper operation. Either the retard side vacuum hose or electrical connection is disconnected and the change in ignition timing is observed. If there is a shift in ignition timing in the correct direction, the unit is rated OK.

(5.) Keymode Diagnostic Inspection

An evaluation of ignition system performance, ignition misfire, air cleaner restriction, PCV system flow, and air injection pump performance is made using the Clayton Keymode Cycle diagnostic modes, Reference 3. The Clayton Keymode Cycle consists of steady state cycles at high engine load, moderate engine load and idle. The Keymode cycle is described in Section 2.3.2. All of the performance evaluations are made during the high and low cruise. In addition, the ignition system and air injection performance measurements are performed at idle. The measurement techniques that are employed are described as follows:

a) Spark Plug Required Voltage

The ignition analyzer scope is connected and set to the parade display. The minimum and maximum observed firing kilovolt readings are recorded.

b) Misfire Rate

With the same ignition scope set-up that is described in a), misfire is considered to be present if an open circuit is observed in the firing line and no spark line is present. The percentage is based on the total number of spark plug firings that are available, i.e., if one spark plug in an eight cylinder engine is misfiring all of the time the misfire rate is 12.5%.

c) Air Cleaner Restriction

The complete air cleaner assembly and attachments are installed in their normal arrangement. The air cleaner hold-down wing nut is removed and the end of a hose is butt connected at the air cleaner housing opening around the attachment stud. The other end of the hose is connected to a vacuum/pressure gauge. The air cleaner housing vacuum that is observed is recorded for the two engine load conditions.

(3.6) Choke Vacuum Diaphragm

On those vehicles equipped with a choke vacuum diaphragm, vacuum is applied to the diaphragm. If the diaphragm does not retract, it is failed and a NG is recorded.

(3.7) Heat Riser Valve-On

On vehicles equipped with an exhaust heat riser valve the valve is inspected manually for freeness of operation. If the operation is not free, a FROZEN rating is entered.

(4.) Emission Control

(4.1) PCV Performance at Idle

With all the vehicle's PCV system components properly installed, the crankcase vacuum is measured at the oil dipstick tube. The vacuum or pressure is recorded in inches of water. The fresh air inlet to the PCV system is not blocked off with this procedure.

(4.2) Vacuum Leaks

Accessory vacuum hose leaks are diagnosed at idle by pinching off each hose individually near its source of vacuum. A leak is detected if the idle quality changes noticeably (i.e., idle rpm changes).

(4.3) Idle rpm Change

If an idle rpm change is detected in item 4.2, the difference in rpm is recorded.

(4.4) NO_x Control Device

Vehicles that have a distributor vacuum advance control that is controlled by either speed or transmission gear position are evaluated for proper operation of the vacuum advance control. The vehicle is gradually accelerated from a stop to about 40 mph. If the vacuum advance control does not operate according to the manufactuer's specifications within reasonable limits, the device is rated NG.

d) PCV Flow

A laminar element flow gauge is connected to the upstream side of the Positive Crankcase Ventilation Valve. The downstream side of the PCV Valve is connected in its normal operating configuration. The flow rate is observed and recorded.

e) Air Pump Disconnected

The air injection pump is disconnected from the air distribution manifold and the manifold is plugged off. The direct concentration exhaust emissions of carbon monoxide, carbon dioxide, and hydrocarbons are monitored and recorded on standard strip charts. The exhaust emissions at this condition are compared to the exhaust emissions obtained during the standard emission test sequence when the air injection pump is properly connected. Any deficiencies and pertinent items that are observed beyond those recorded on the standard inspections sheet are recorded under "Comments."

The vehicle parameter inspection was expanded during the seventh month of the experimental program (midway through the first recall). The measurement of idle carbon monoxide emissions during the engine parameter inspection (floor inspection) was instituted. This measurement was performed on Vehicle Fleets I and II to verify the fuel air mixture adjustments made during initialization of the vehicles to manufacturers' specifications. This procedure was initiated because of an indicated discrepancy between the idle CO values observed during the post tune-up emission test sequence and the manufacturers' specifications.

The other parameter diagnostic procedure adopted was the performance of a cylinder balance check. The cylinder balance check is performed with the ignition analyzer scope by sequentially spark plug shorting of cylinders, i.e., there is no ignition spark for a selected cylinder. The ignition scope provides a reading of percent loss of engine speed for each cylinder test. This test was performed at the low speed cruise of the Keymode Cycle and at 1500 rpm in neutral during the floor inspection. This procedure was undertaken due to the indication that ignition misfire was not being accurately detected by the previously discussed procedure.

2.2.2 Initialization Maintenance Procedures

Each vehicle in the deterioration fleet received a comprehensive engine tune-up after the "as-received" emission test and parameter inspection had been performed. This tune-up was performed in order to initialize the vehicle so that the deterioration of new components and settings with mileage and time could be monitored. The baseline or reference emission level prior to deterioration was measured in test 1B which was performed immediately after vehicle initialization.

Regardless of their condition, each vehicle was equipped with new spark plugs, ignition condenser, PCV valve and air cleaner element. In every case, idle rpm, idle fuel/air ratio, basic timing, ignition point dwell and the choke vacuum kick were set to manufacturers' specification. In many cases, failed distributor and choke vacuum diaphragms were detected and therefore replaced. All stuck heat riser valves were also freed. The secondary ignition components, i.e., high tension cables, rotors and distributor caps were replaced whenever they were found to be in poor condition. Occasional major carburetor and distributor repairs were performed in order to obtain acceptable vehicle operation. The tune-up parts used were major manufacturer brands.

All of the mechanical settings were accomplished using conventional mechanical and electrical equipment and standard practice procedures. The distributor advance specifications were obtained from Sun Specification Service Manual, Reference 4, and all other tune-up specifications were obtained from National Service data manuals, Reference 5. The settings of idle rpm and basic timing were made in strict compliance with the manufacturers' published procedures. The idle mixture settings were set for "best lean idle" on the vehicles with no emission controls (Pre-Emission Controlled Vehicles, Fleet I). "Best lean idle" was accomplished by leaning the mixture until a lean engine roll or rpm drop was observed and then richening the mixture to increase the idle rpm by 20. Emission controlled vehicles (Fleet II and Fleet III) idle settings were made using the most definitive procedures known. These procedures resulted in either a % CO setting or best idle setting. The specifications that are employed are listed in Table 2.3.

TABLE 2.3

Idle CO % Specifications

Vehicles Equipped with Exhaust Emission Controls

General Motors-Follow engine compartment or tune-up manual procedures.

These procedures are based on rpm drop with the mixture screw. 1971 Chevrolet, Pontiac and Oldsmobile have % CO specifications listed in the tune-up manual.

Chrysler Corporation - Set 1.0% CO at the specified rpm with transmission set in neutral.

Ford Motor Company - Set the idle % CO at the specified rpm with the transmission in neutral.

The % CO specifications are listed in the Ford (Reference 6) Emissions Analyzer Manual. The specifications listed for 1968 model vehicles are applicable to 1967 and 1966 California Vehicles. The idle % CO setting for 1971 vehicles are listed in the tune-up manual.

American Motors - 1968 through 1971 vehicles are set from 1.0 to 1.5 % CO.

1966 and 1967 California vehicles are set for best lean idle.

All Others - Set to whatever specifications are available in the tune-up manual.

2.2.3 Unscheduled Maintenance and Repairs

The program goal was that a minimum number of vehicles would receive additional tune-up maintenance during the course of the vehicle deterioration test program. All participating vehicle owners were informed at the beginning of the program that their vehicles would undergo a major tune-up at the end of the test series, sixteen months from the time of their vehicle's first test. It was anticipated that the incentive of a major tune-up at the end of the test period would be sufficient to delay his routine, periodic tune-up maintenance until the end of the test series. During the period of the first recall testing (Test 2), it was discovered that a substantial number of owners had obtained various and sometimes extensive tune-up related repairs. At the beginning of the second recall testing (Test 3) a letter was therefore sent to the vehicle owners reminding them of the scheduled tune-up at Test 5. However, extensive maintenance and even complete tune-ups were being performed on many of the vehicles. Vehicles were also returned to Scott at either the scheduled recall or between tests with various performance complaints. These complaints, however, were corrected only when judged to be necessary. In addition, a code system was established to maintain a complete record of all unscheduled maintenance and to facilitate automatic data processing.

Due to this greater than expected degree of unscheduled maintenance, additional procedures were instituted in order to maximize the usefulness of data obtained from vehicles which received unscheduled maintenance. During the period that Test 2 was being performed (first recall) the vehicles that had received excessive maintenance were reinitialized and retested. In cases where only minor adjustments were required, the adjustments were documented along with the before and after diagnostic readings. Reinitialization involved retuning the vehicle as described in Section 2.2.2, and assigning a new number to that vehicle and reinstituting the vehicle in the program at Test 1B. Retesting required an additional test after a scheduled test in order to quantify the effect of maintenance and to establish a reference emission level.

Engine Parameter Adjustment/Repair Record (Figure 2.7) was used to document minor parameter changes that were performed at Scott. Figure 2.8, Procedure for Repairing Fleet Test Vehicles, presents the guidelines that were followed during Test 2 for determining if a retest, reinitialization, or minor repair should be performed.

For Test 3 (second recall after initialization) it was judged that retesting vehicles after minor repair of parameters which influence emissions was of limited value. Therefore, when repairs were required the vehicle was reinitialized to manufacturers' specifications and renumbered.

2.3 EXHAUST EMISSION TESTS

Exhaust emission measurements were performed on each vehicle before and after the initial tune-up and at each scheduled four-month vehicle recall. The "as received" and post tune-up tests were designated Tests 1A and 1B, respectively. The first recall test, conducted four months after Test 1, was identified as Test 2 and the second recall test, after an additional four-month period, was identified as Test 3.

2.3.1 Exhaust Emission Test Procedures

The exhaust emission tests were made in accordance with applicable Federal Register test procedures and instrumentation, References 7 and 8. The exhaust emission tests involved both Constant Volume Sampling mass and direct, tail pipe concentration measurements. The mass emission, dilute exhaust bag samples were analyzed with non-dispersive infrared instrumentation for carbon monoxide (CO) carbon dioxide (CO_2) and nitric oxide (NO). Flame ionization detection instrumentation was used for the analysis of total unburned hydrocarbon (HC), and non-dispersive ultraviolet instrumentation was used for the analysis of nitrogen dioxide (NO_2). The direct exhaust emission concentrations were analyzed for carbon monoxide, carbon dioxide, n-hexane equivalent unburned hydrocarbons, and nitric oxide with non-dispersive infrared instrumentation. In addition, for both mass and concentration measurements, a chemiluminescence analyzer, i.e., converter and chemiluminescent NO analyzer system, was incorporated during the third month of the testing program and was used for the analysis of total oxides of nitrogen.

Fleet Deterioration Program

Form 1.4

Engine Parameter Adjustment/Repair Record

1. Vehicle Identification

1.1 Last Test No. ______________________

1.2 Car No. ______________________

1.3 License No. ______________________

1.4 Repaired by ______________________

1.5 Date ______________________

1.6 Odometer ______________________

2. Complaint or Problem

____

____

____

____

3. Repair(s) or Adjustment(s) Made

____

____

____

____

4. Diagnostic Readings

	Item Affected	Measurement Before Adjustment	Measurement After Adjustment
1			
2			
3			
4			
5			

Figure 2.7 Engine Parameter Adjustment/Repair Record

FIGURE 2.8

PROCEDURE FOR REPAIRING FLEET TEST VEHICLES

Case I - Owner Complaint at a Time Other than a Scheduled Test

a. For a complaint requiring a minor adjustment or repair that is not expected to have a pronounced or indeterminate effect on exhaust emissions, only the minor repair will be made. This would include the following items:

1. Basic timing
2. Idle rpm
3. Choke setting
4. Points & condenser
5. Rotor or Distributor Cap
6. Vacuum Hoses
7. Ignition misfire (wires or plugs)
8. Idle mixture adjustments
9. Choke diaphragm
10. NO_x control
11. Heat riser valve
12. PCV system

The odometer mileage, work done, before and after related diagnostic readings, and date are to be recorded (Form 1.4). No emission test will be run.

b. For a complaint requiring service of a component that will most likely have a large, indeterminate effect on exhaust emission baseline, and will cause the owner to seek an ultimate resolution, the following procedure will be followed:

Scott will correct the malfunction and record the odometer mileage, work done, before and after complete diagnostic readings and date (Form 1.3 and 1.4). A complete emission test will be run after the repair. Work that fits into this category will include:

1. Major carburetor repair or replacement
2. Distributor replacement
3. Timing retard mechanism
4. Major overhaul or repair if Scott is responsible

Vehicles repaired under items 1 and 4 above will be reinitialized and renumbered. (Becomes Case II)

FIGURE 2.8 (Cont'd)

Case II - Vehicles Returned for Scheduled Test which Have Had Major Maintenance by Owner

If the owner has had major engine or tune-up work such as a new engine, engine overhaul, valve job, carburetor overhaul, new carburetor, or major tune-up the vehicle will be reinitialized (specified Tune-Up and Adjustments). The vehicle will then be given the standard emission test.

Case III - Vehicles Returned for Scheduled Test Having an Owner Complaint or Component Malfunction that would Result in Owner Complaint

The vehicle should first be tested "as received". If a malfunction or maladjustment is discovered during the inspection and it effects vehicle performance to the extent that the owner will have maintenance performed, that (those) item(s) will be repaired or adjusted.

a. If the adjustment or repair is not expected to have a pronounced, indeterminate effect on exhaust emissions (See Case I, Item a, except for NO_x Control Ignition Misfire and Choke Diagram), only the repair will be made. Form 1.4 will be completed.

b. If the repair has a major impact on emissions an "after-repair" test will be run. (B Test) These items will include:

1. Choke diaphragm
2. Misfire
3. NO_x control
4. Major carburetor work
5. Major engine repairs that are Scott responsibility
6. Distributor replacement
7. Timing retard mechanism

Vehicles repaired under items 4 and 5 above will be reinitialized and renumbered. (Becomes Case II) A complete inspection (Form 1.3 & 1.4) will be made.

NOTE: 1. Test Identification:

Emission tests that are run after a scheduled test (such as a standard test 2) will be labeled with sequential alphabetical characters; i.e., first rerun will be 2B, second rerun will be 2C.

Vehicles that are reinitialized at or after test 2 will have test labeled 1B and will receive a new number as follows:

Fleet No.	New Vehicle Numbers
1	451-500
2	501-550
3	551-600

Since all of the emission tests involved either the 1972 or 1975 Federal procedure, the vehicles were soaked for the minimum twelve hour time period before conducting the cold start tests. The program was initiated using the 1972 Federal Procedure but a change to the 1975 Federal Procedure was made during the last month of test during the first recall (Test 2). Indolene 30 test fuel, which meets the Federal test requirements, was used whenever possible, during all of the emission test cycles. Vehicles that were equipped with in-tank fuel pumps and foreign vehicles having fuel lines that were difficult to disconnect were consistently tested using the vehicle's tank fuel (of the total test fleet of 450 vehicles, 13 were tested with tank fuel). The dynamometer inertia weight and road load horsepower were set according to the 1972 Federal Test Procedure.

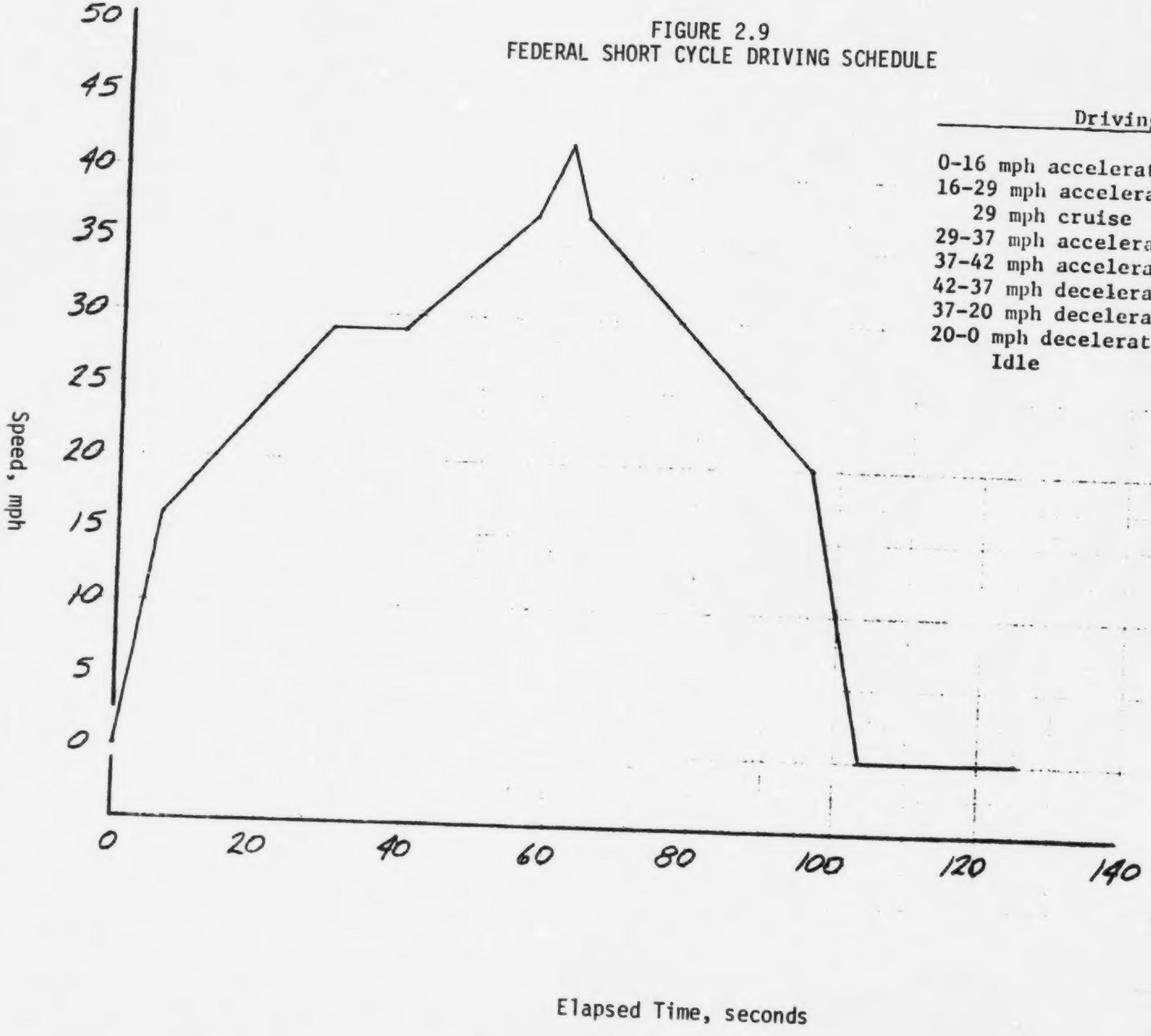
2.3.2 Exhaust Emission Test Cycles

Each vehicle test incorporated the measurements of the exhaust emission using the 1972 or 1975 Federal Test Procedure from a cold start, the Federal Short Cycle and short diagnostic cycles. The Federal Test Procedure and the Federal Short Cycle tests require CVS mass emission measurements. The short diagnostic cycle emissions were measured on a direct concentration basis. Only the Federal Test Procedure was run from a cold start, the other two test cycles were run with warm engine. The emission testing sequence is summarized below. The following sequence was used:

a) Federal 1972 or 1975 Cold Start
b) Two hot 7-mode cycles (test 1A only)
c) Federal short cycle
d) Clayton Keymode cycles while performing parameter inspection
e) Short Diagnostic cycles while measuring exhaust emissions (which included the 49/45 mph, 33/30 mph and idle Clayton Keymodes).

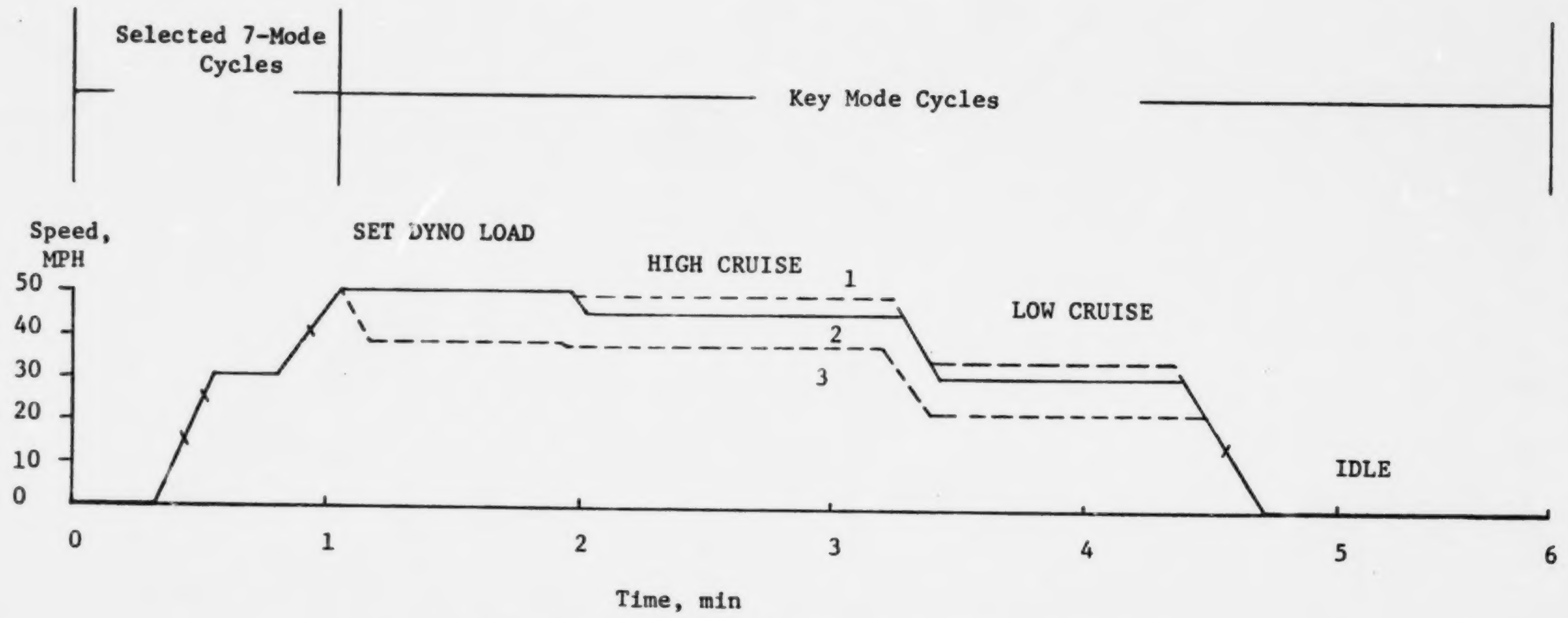
As indicated above, at the time of the "as-received" test (Test 1A) an additional emission test was run. This test was a closed seven-mode cycle CVS test from a hot start. Two 7-mode cycles, the 1968-71 Federal Test Procedure driving cycle were run and the Constant Volume Sample mass emissions was determined. In addition, the direct concentration readings were recorded simultaneously for the 7-mode cycle at the beginning of the 8-month program. The 1975 Federal Test Procedure was substituted for the 1972 Federal Test Procedure. The Federal Short Cycle driving scheduled is presented in Figure 2.9. The short diagnostic cycles which include the Clayton Keymode Cycles are illustrated in Figure 2.10. The specifications used for the keymode cycles are shown on Table 2.4.

FIGURE 2.9
FEDERAL SHORT CYCLE DRIVING SCHEDULE



Driving Mode	Time in Mode, Seconds
0-16 mph acceleration	6
16-29 mph acceleration	23
29 mph cruise	10
29-37 mph acceleration	18
37-42 mph acceleration	4.5
42-37 mph deceleration	2.5
37-20 mph deceleration	32
20-0 mph deceleration	7.5
Idle	21.5
	125 sec.
	.7536
	21.7 mph

FIGURE 2.10
SHORT DIAGNOSTIC CYCLES



Driving Schedules for Vehicles vs. Inertia Weight Settings

1. 4000 lbs and heavier Inertia
2. 3000 - 4000 lbs Inertia
3. 2500 lbs and lighter Inertia

TABLE 2.4

Key Mode Cycles

Vehicle Inertia Weight	Horsepower Setting	Driving Cycles		
		High Cruise	Low Cruise	Idle
4,000 lbs. & up	30 HP @ 50 MPH	49 MPH	33 MPH	0
3,000-3,500 lbs.	30 HP @ 50 MPH	45 MPH	30 MPH	0
2,000-2,500 lbs.	15 HP @	37 MPH	23 MPH	0

Notes:

1. 2,000-2,500 lb. vehicles with four speed transmissions are driven in third gear.
2. Automatic transmissions are set in neutral at idle.

2.4 INSTRUMENTATION AND TEST EQUIPMENT

Whenever possible conventional equipment was used to obtain both the engine parameter and emission measurements. A brief description of all equipment that was employed is given below.

2.4.1 Engine Parameter Inspection Equipment

The measurements described in Section 2.2.1 and the tune-up adjustments described in Section 2.2.2 were performed with the following equipment:

A) Engine Analyzer with Ignition Scope
An Autoscan Model 4000 Series Diagnostic System was used. This engine analyzer included the ignition oscilloscope, tachometer, dwell meter, vacuum gauge, % speed power change test meter, timing advance meter, and timing light.

B) Air Filter Tester
The air cleaner element tester was an AC Model 0 air filter tester. A protractor was installed on the face of the tester in order to obtain the readings in angular degrees from 0 to 180.

C) Garage Carbon Monoxide Meter
An Horiba, Type MEXA-200 Motor Vehicle Exhaust Gas Analyzer was used to set and measure the garage floor idle CO concentration. This is a non-dispersive infrared instrument, with 0 to 5 Volume % range and claimed accuracy of ±5% of full scale.

D) PCV Flow Rate Meter
A Model 50 Vol-0-Flow meter, manufactured by National Instrument Laboratories, Inc. was used to measure the PCV system flow rate. This is a laminar flow meter with a differential pressure gauge and has a nominal flow range of 0 to 10 CFM.

E) Crankcase Pressure Gauge
A "U" Tube water manometer was employed to determine the crankcase pressure.

F) Choke Vacuum Kick Gauges

The choke vacuum kick settings were measured with a Kent-Moore J-9789-01 plug gauge set.

2.4.2 Emission Test Equipment

The equipment used for the exhaust emission measurements was constructed with standard commercial components in accordance with the Federal Test Procedure requirements. The several instrument systems were combined so that direct concentration samples could be taken simultaneously with the CVS bag samples. The direct concentration samples were returned to the dilution duct so that they would not bypass the bag collection. Dual range instrumentation was also employed whenever possible and all standard operating modes such as calibration sampling and analysis and purging were semiautomatically controlled from a single, push button operated control panel for simplicity and speed of operation. The specific instrument units are described below.

a) Non-Dispersive Infrared System for Measurement of CO, CO_2 and HC

A Scott Research Laboratories Model 103-11X instrument system employing Beckman 315A analyzers was used for the analysis of Carbon Monoxide, Carbon Dioxide and n-hexane equivalent Hydrocarbons. Two ranges of HC analyzers were used: 1,500 ppm and 10,000 ppm full scale. The CO_2 analyzer had a full scale range of 16%. A stacked cell CO analyzer was used. The direct concentration measurement required the full scale range and the bag sample required the 1% of full scale range. The low range cell was operated on two ranges, 0.4% and 2.0% full scale, for the 1975 Federal Test Procedure.

b) FID Analyzer for Measurement of Total Hydrocarbons

A Beckman Instrument Model 108A Flame Ionization Detection hydrocarbon analyzer was used to measure the dilute bag sample total hydrocarbons. Multirange attenuation was used to set the appropriate full scale values.

c) NDIR/NDUV Analyzer for Measurement of NO and NO_2

A Scott Research Laboratories Model 107-2 NO_x analyzer was used to measure both nitric oxide and nitrogen dioxide emissions. A Beckman Instrument 315, a non-dispersive infrared analyzer was used to measure NO concentration and dilute bag sample emissions. The full scale ranges were 5000 ppm and 500 ppm, respectively. A Beckman Instrument 315-A non-dispersive ultraviolet analyzer was used to measure the dilute bag sample emissions of NO_2 with a full scale range of 200 ppm.

d) Mass Sampling System

A Scott Research Laboratories Model 301 Constant Volume Sampler was used to collect the mass emission samples. Five sample bags were incorporated in the system, with the ability to analyze one bag sample while collecting another.

e) Chemiluminescence NO_x Analyzer

A government furnished Chemiluminescence analyzer (NO_2 Converter/Chemiluminescent NO analyzer system) was incorporated for the analysis of oxides of nitrogen during the third month of the testing program. This unit was operated in conjunction with the NDIR/NDUV analyzer for the remainder of the program. This unit was a Thermo Electron Corporation Model 10A Analyzer. The Chemiluminescence analyzer and thermal converter were assembled in a sample train which was operated independently of the above described emission equipment. The NO_x exhaust emission samples were always analyzed concurrently with the other instruments. The CVS bag samples were analyzer in the NO_x mode (converter on) with range attenuation set for 250 ppm full scale. Direct concentration NO emissions were analyzed with the converter bypassed and the attenuator set to 5500 ppm full scale.

f) Chassis Dynamometer

A Clayton Manufacturing CT-200 Chassis Dynamometer was used for all emission tests. The dynamometer had a 2000 to 5000 pound inertia system, adjustable in 500 pound increments. A 50 horsepower torque bridge was used for the road load horsepower settings.

2.4.3 Instrument Maintenance and Calibration

The emission analysis equipment received preventive maintenance on a weekly basis. The emission instruments were calibrated monthly. Most of the instruments were calibrated with at least a five point curve plus zero. All of the calibration gases, including the span gases used to set the instruments for each test were ±2% tolerance. A system start-up procedure which included an instrument curve verification and leak check was followed every day. Tachometer calibrations were checked on a weekly basis.

2.5 DATA REDUCTION PROCEDURES

Because of the extensive data reduction and analysis requirements of the Extended Phase One Emission Test Program, a total data management system was developed. This section presents the detailed description of the system that was implemented in support of the program.

2.5.1 Data Reduction and Analysis System

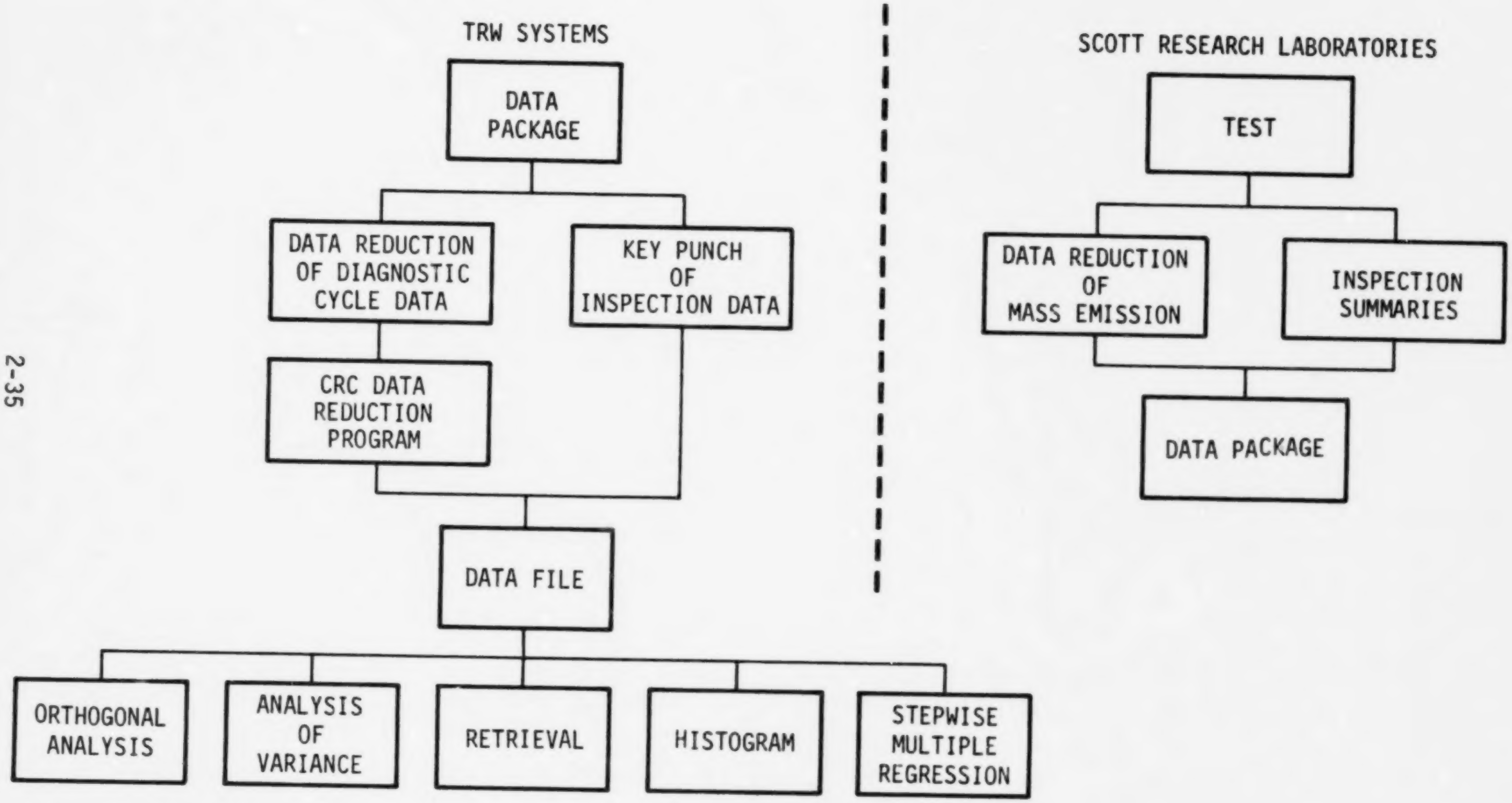
Review of the requirements of the program indicated that in order to properly process data for publication and to obtain the maximum amount of information from the experimental program, a system which would provide the following capabilities would be required:

- reduce test data
- store test data
- retrieve data
- compute statistics
- develop graphical presentations
- develop regression equations
- perform analyses of variance

A system was therefore developed which made maximum use of the capabilities of Scott Research Laboratories (SRL) and TRW Systems. The partitioning of the activities is illustrated in Figure 2.11. Since all of the testing was

FIGURE 2-11

DATA REDUCTION AND ANALYSIS SYSTEM


TRW SYSTEMS
DATA PACKAGE
DATA REDUCTION OF DIAGNOSTIC CYCLE DATA
KEY PUNCH OF INSPECTION DATA
CRC DATA REDUCTION PROGRAM
DATA FILE
ORTHOGONAL ANALYSIS
ANALYSIS OF VARIANCE
RETRIEVAL
HISTOGRAM
STEPWISE MULTIPLE REGRESSION
SCOTT RESEARCH LABORATORIES
TEST
DATA REDUCTION OF MASS EMISSION
INSPECTION SUMMARIES
DATA PACKAGE

to be undertaken by SRL, all of the recorded emission data and the reduced CVS data were combined to form a total data package that was to be submitted to TRW. TRW in turn was charged with the responsibility for systematically processing the data for further analysis and publication.

The program required that a large amount of data be recorded by the technicians on the test floor. Because the information was to be submitted to the computer, special forms were developed which constituted a compromise between the specific formats required for computer processing and the descriptive information that is customarily acquired by technicians. A sample of the types of forms that were used is presented in Figures 2.4 and 2.5.

The completed forms, as previously discussed, together with strip chart records and the computed results of the mass emission tests, were submitted to TRW as a data package. The inspection data was submitted to keypunch and the mass emissions data was merged with the diagnostic cycle emission test data processed by TRW. The merging of the mass emissions data with the diagnostic cycle emission concentration data was made by TRW because the data processing personnel were more accustomed to the rigorous computer format used in computer systems than were the technicians of SRL.

In order to reduce transportation and procedural errors, a system of data formatting, editing and review was initiated. The data were initially keypunched and submitted to the computer in a batch mode. Data listings were reviewed and corrections were made by editing the data bank using the remote terminal, TRW Time Share System. Review of the data and editing of the data was therefore performed on a real time basis, on the computer, with full control by the data processing technician. All of the process computer programs are also controlled by teletype terminal control and large data outputs are developed on a batch mode with the high speed printer. The program, at present, therefore has the capability of submitting large banks of data to the computer in batch mode with total control of storage, retrieval and analyses on a demand basis by use of the remote terminal, Time Share System.

2.5.2 Description of Computer Programs

The total system developed to process the test data consists of a group of Fortran computer programs (most of which are used in an interactive time share mode) and a master data file (with tape back up). The system is implemented on the TRW/TSS computer system which utilizes a CDC 6500 machine. With exceptions of the data input (CRC and DETER) and the orthogonal analysis of variance (ORTHO and CHOKE) programs, the system is general and designed to be easily adapted to any data set. Figure 2.12 presents an overall view of the system and illustrates how the various programs interact to constitute the total data management system.

As illustrated in the figure, a large number of computer programs were developed as a part of the overall system. A brief description of each of the programs is presented.

2.5.2.1 Input Programs

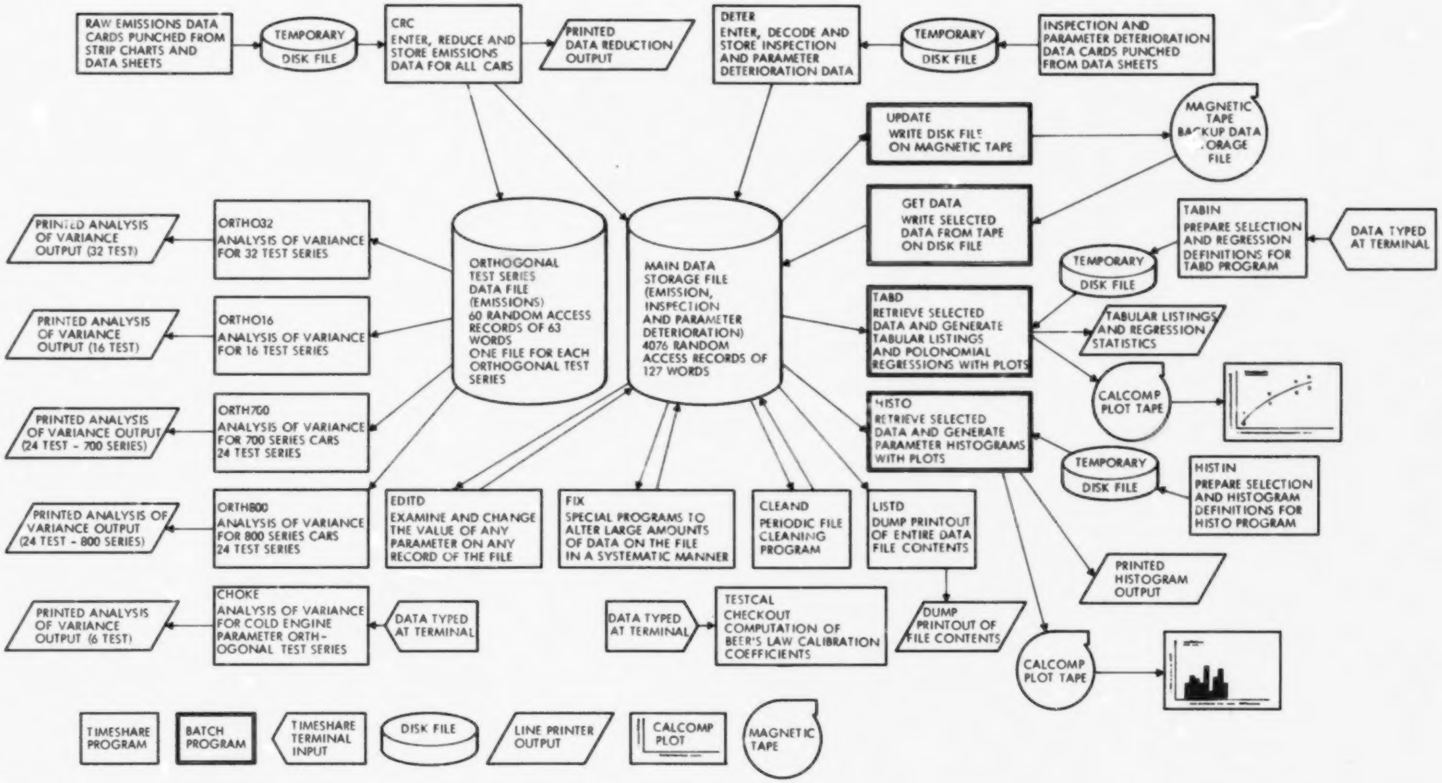
Two programs, CRC and DETER, were written to systematically process the input data. CRC is used to process emission related data and DETER is used to process parameter inspection data. The two programs were written because of the difference in the type of information and the type of processing required for the two data sets. Emission measurements primarily required processing of strip chart data by use of the calibration curves. The program therefore was written to automatically adjust the calibration curves for the test to test variation in the calibration reference points. In contrast, the inspection related information required simply reformatting of data to fit storage requirements. The program was written to systematically process, perform simple computations such as deviations from specifications, and store the information. Both of these programs were written to the rigid structures required for the Phase I test program.

2.5.2.2 Editing Programs

Some of the information processed was expected to be in error. Several programs therefore were written to allow systematic identification and correction of the information. The program EDITED was written to allow

FIGURE 2.12

COMPUTER PROGRAM INTERFACES


RAW EMISSIONS DATA CARDS PUNCHED FROM STRIP CHARTS AND DATA SHEETS
TEMPORARY DISK FILE
CRC ENTER, REDUCE AND STORE EMISSIONS DATA FOR ALL CARS
PRINTED DATA REDUCTION OUTPUT
DETER ENTER, DECODE AND STORE INSPECTION AND PARAMETER DETERIORATION DATA
TEMPORARY DISK FILE
INSPECTION AND PARAMETER DETERIORATION DATA CARDS PUNCHED FROM DATA SHEETS
UPDATE WRITE DISK FILE ON MAGNETIC TAPE
MAGNETIC TAPE BACKUP DATA STORAGE FILE
GET DATA WRITE SELECTED DATA FROM TAPE ON DISK FILE
TABIN PREPARE SELECTION AND REGRESSION DEFINITIONS FOR TABD PROGRAM
DATA TYPED AT TERMINAL
TEMPORARY DISK FILE
TABD RETRIEVE SELECTED DATA AND GENERATE TABULAR LISTINGS AND POLONOMIAL REGRESSIONS WITH PLOTS
TABULAR LISTINGS AND REGRESSION STATISTICS
CALCOMP PLOT TAPE
HISTO RETRIEVE SELECTED DATA AND GENERATE PARAMETER HISTOGRAMS WITH PLOTS
TEMPORARY DISK FILE
HISTIN PREPARE SELECTION AND HISTOGRAM DEFINITIONS FOR HISTO PROGRAM
PRINTED HISTOGRAM OUTPUT
CALCOMP PLOT TAPE
ORTHOGONAL TEST SERIES DATA FILE (EMISSIONS) 60 RANDOM ACCESS RECORDS OF 63 WORDS ONE FILE FOR EACH ORTHOGONAL TEST SERIES
MAIN DATA STORAGE FILE (EMISSION, INSPECTION AND PARAMETER DETERIORATION) 4076 RANDOM ACCESS RECORDS OF 127 WORDS
PRINTED ANALYSIS OF VARIANCE OUTPUT (32 TEST)
ORTHO32 ANALYSIS OF VARIANCE FOR 32 TEST SERIES
PRINTED ANALYSIS OF VARIANCE OUTPUT (16 TEST)
ORTHO16 ANALYSIS OF VARIANCE FOR 16 TEST SERIES
PRINTED ANALYSIS OF VARIANCE OUTPUT (24 TEST - 700 SERIES)
ORTH700 ANALYSIS OF VARIANCE FOR 700 SERIES CARS 24 TEST SERIES
PRINTED ANALYSIS OF VARIANCE OUTPUT (24 TEST - 800 SERIES)
ORTH800 ANALYSIS OF VARIANCE FOR 800 SERIES CARS 24 TEST SERIES
EDITD EXAMINE AND CHANGE THE VALUE OF ANY PARAMETER ON ANY RECORD OF THE FILE
FIX SPECIAL PROGRAMS TO ALTER LARGE AMOUNTS OF DATA ON THE FILE IN A SYSTEMATIC MANNER
CLEAND PERIODIC FILE CLEANING PROGRAM
LISTD DUMP PRINTOUT OF ENTIRE DATA FILE CONTENTS
PRINTED ANALYSIS OF VARIANCE OUTPUT (6 TEST)
CHOKE ANALYSIS OF VARIANCE FOR COLD ENGINE PARAMETER ORTH-OGONAL TEST SERIES
DATA TYPED AT TERMINAL
DATA TYPED AT TERMINAL
TESTCAL CHECKOUT COMPUTATION OF BEER'S LAW CALIBRATION COEFFICIENTS
DUMP PRINTOUT OF FILE CONTENTS
TIMESHARE PROGRAM
BATCH PROGRAM
TIMESHARE TERMINAL INPUT
DISK FILE
LINE PRINTER OUTPUT
CALCOMP PLOT
MAGNETIC TAPE

examination of any data point and to allow a change of any value of any parameter recorded on file. This program was used to make specific data changes. In anticipation of changing large blocks of data, the program FIX was written. The program was used to adjust data fields which were found to be in error by a constant or linear amount. Because of the large number of analyses being conducted on various phases of the program, the program (CLEAND) was written to allow periodic removal of large amount of data (test or input algorithms) stored on file.

2.5.2.3 Magnetic Tape Interface Programs

Because of the large data base, the total system uses permanent magnetic tape data storage. This approach serves two purposes: 1) provides a back-up for all of the information that was stored on file to preclude the possibility of loss of the test data, and 2) provides a more cost effective method of handling the data when the project is in a data collection phase. This capability will be particularly useful in the second year of engine parameter deterioration testing when only a minimum amount of analyses will be performed. Data from the magnetic tape will be fed into the computer only when data summaries and analyses are required. The high cost of storing data on file throughout the whole test period will therefore be partially eliminated.

2.5.2.4 Retrieval Programs

A major part of the analysis activity is to selectively summarize information and to develop plots. A group of three programs was therefore written to perform retrieval and plotting type functions. The programs needed to be totally flexible and to allow selection of a variety of data displays. The programs TAB D and HISTO were developed to allow retrieval of the data records of the 127 stored parameters. The parameters that are stored are listed in Table 2.5. The selection criteria allows either or both AND and OR compounding of criteria.

TAB D is used primarily to list the data and to compute the simple statistics (estimate of mean, standard deviation, degrees of freedom and student T values). HISTO is used to develop histograms of any functions.

TABLE 2.5

DEFINITION OF PARAMETER DETERIORATION AND PARKING LOT SURVEY DATA STORAGE FILE RECORD

A. INSPECTION DATA ENTERED THROUGH DETER PROGRAM (NOTE: -999 = -0. = MISSING DATA FLAG)

WORD OR LOCATION	SOURCE CARD	SOURCE FIELD	VALUE INPUT EXAMPLE	VALUE STORED EXAMPLE	TITLE	DESCRIPTION, NOTES AND CODES
1	A	1	1A	1.1	TEST NO	TEST NUMBER (1A = 1.1, 1B = 1.2, 5A = 5.1, 5B = 1.2)
2	A	2	0001	1.	CAR NO	CAR NUMBER (1-545 OR 1001-1260)
3	A	3	2645	2645.	WEIGHT	CAR WEIGHT (CURB WEIGHT + 300 LB)
4	A	4	61	61.	YEAR	YEAR
5	A	5	FORD	9.	CAR MAKE	MAKE (BUICK = 1., CADILLAC = 2., CHEVROLET = 3., OLDSMOBILE = 4., PONTIAC = 5., CHRYSLER = 6., DODGE = 7., PLYMOUTH = 8., FORD = 9., MERCURY = 10., RAMBLER = 11., VOLKSWAGEN = 12., MISCELLANEOUS = 13.)
6	A	6	170	170.	ENG DISP	ENGINE DISPLACEMENT (IN^3)
7	A	7	101	101.	HORSEPOWER	HORSEPOWER
8	A	8	HOLL	1.	CARB MAKE	CARBURETOR MAKE (HOLLEY = 1., CARTER = 2., FORD = 3., SOLEX = 4., STROMBERG = 5., ROCHESTER = 6., MISCELLANEOUS = 7.)
9	A	9	1	1.	CARB BBLS	CARBURETOR BARRELS
10	A	10	AUTO	1.	TRANS TYPE	TRANSMISSION TYPE (MANUAL = 0., AUTOMATIC = 1.)
11	A	11	NONE	0.	EXHAUST	EXHAUST EMISSION SYSTEM CODE (NONE = 0., CAP = 1., AIR = 2., EM = 3., MISCELLANEOUS = 4.)
12	A	12	1	1.	CRANKCASE	CRANKCASE EMISSION SYSTEM CODE
13	A	13	87180	87180.	MILEAGE	ODOMETER READING
14	A	14-16	5,25,71	145.	TEST DATE	DATE OF TEST (STORED IN NUMBER OF DAYS FROM 1/1/71)
15	A	17	1.	1.	REPAIR	TYPE OF REPAIR CODE (NONE = 0., CODES = 1.-99. PER VEHICLE REPAIR CODE SHEET)
16	B	1-2	9,12	10.5	RQ VOLT MS	REQUIRED VOLTAGE AT 1500 RPM, MEASURED, KV (VALUE STORED IS MEAN) (SEE ALSO WORD 63 FOR RANGE)
17	B	3	12	-1.5	RQ VOLT DV	REQUIRED VOLTAGE AT 1500 RPM,DEVIATION FROM SPECIFICATION, KV
18	B	4	32	32.	COIL AV MS	COIL AVAILABLE VOLTAGE AT 1500 RPM, MEASURED, KV
19	B	5	34	-2.	COIL AV DV	COIL AVAILABLE VOLTAGE AT 1500 RPM, DEVIATION FROM SPECIFICATION, KV

TABLE 2.5 (Cont'd)

WORD OR LOCATION	SOURCE		VALUE INPUT EXAMPLE	VALUE STORED EXAMPLE	TITLE	DESCRIPTION, NOTES AND CODES
	CARD	FIELD				
20	B	6	OK	0.	SPARK LINE	SPARK LINE (OK = 0., NG = 1.)
21	B	7	OK	0.	COIL OSCIL	COIL OSCILLATIONS (OK = 0., NG = 1.)
22	B	8	1	1.	POINT OPEN	POINT OPENING VARIATION, DEGREES
23	B	9	OK	0.	COIL POLAR	COIL POLARITY (OK = 0., NG = 1.)
24	B	10	60	60.	PT DWEL MS	IGNITION POINT DWELL, MEASURED, DEGREES
25	B	11-12	38,48	12.	PT DWEL DV	IGNITION POINT DWELL, DEVIATION FROM SPECIFICATION, DEGREES
26	B	13	OK	0.	COND OSCIL	CONDENSER OSCILLATIONS (OK = 0., NG = 1.)
27	B	14	10	10.	IG TIMG MS	BASIC IGNITION TIMING, MEASURED, DEGREES
28	B	15	10	0.	IG TIMG DV	BASIC IGNITION TIMING, DEVIATION FROM SPECIFICATION, DEGREES
29	B	16	40	40.	TOT ADV MS	TOTAL ADVANCE AT 2500 RPM, MEASURED, DEGREES
30	B	17-18	40,50	0.	TOT ADV DV	TOTAL ADVANCE AT 2500 RPM, DEVIATION FROM SPECIFICATION, DEGREES
31	B	19	20	20.	MEC ADV MS	MECHANICAL ADVANCE AT 2500 RPM, MEASURED, DEGREES
32	B	20-21	10,20	0.	MEC ADV DV	MECHANICAL ADVANCE AT 2500 RPM, DEVIATION FROM SPECIFICATION, DEGREES
33	B	22	31	31.	VAC ADV MS	VACUUM ADVANCE AT 2500 RPM, MEASURED, DEGREES
34	B	23-24	32,33	-1.	VAC ADV DV	VACUUM ADVANCE AT 2500 RPM, DEVIATION FROM SPECIFICATION, DEGREES
35	C	1	500	500.	IRPM MS	IDLE SPEED, MEASURED, RPM
36	C	2	500	0.	IRPM DV	IDLE SPEED, DEVIATION FROM SPECIFICATION, RPM
37	C	3	19	19.	MAN VAC MS	MANIFOLD VACUUM, MEASURED, IN. HG
38	C	4	15	4.	MAN VAC DV	MANIFOLD VACUUM, DEVIATION FROM SPECIFICATION, IN. HG
39	C	5	70	70.	AIR CLN MS	AIR CLEANER ANGLE, MEASURED, DEGREES
40	C	6	50	20.	AIR CLN DV	AIR CLEANER ANGLE, DEVIATION FROM SPECIFICATION, DEGREES
41	C	7	-999	-0.	FLT LEV MS	FLOAT LEVEL, MEASURED, IN. (PARKING LOT SURVEY ONLY)
42	C	8	-999	-0.	FLT LEV DV	FLOAT LEVEL, DEVIATION FROM SPECIFICATION, IN. (PARKING LOT SURVEY ONLY)
43	C	9	0	0.	CH KICK MS	CHOKE, VACUUM KICK, MEASURED, IN.
44	C	10	0	0.	CH KICK DV	CHOKE, VACUUM KICK, DEVIATION FROM SPECIFICATION, IN.
45	C	11	NONE	-1.	DIAPHRAGM	CHOKE VACUUM DIAPHRAGM (NONE = -1., OK = 0., NG = 1.)

TABLE 2.5 (Cont'd)

WORD OR LOCATION	SOURCE CARD	SOURCE FIELD	VALUE INPUT EXAMPLE	VALUE STORED EXAMPLE	TITLE	DESCRIPTION, NOTES AND CODES
46	C	12	NONE	-1.	HEAT RISER	HEAT RISER VALVE (NONE = -1., FREE = 0., FROZEN = 1.)
47	C	13	.2	.2	PCV PERF	PCV PERF AT IDLE, IN. H_2O (VACUUM = -, PRESSURE = +)
48	C	14	NO	0.	VAC LEAKS	VACUUM LEAKS (NO = 0., YES = 1.)
49	C	15	0	0.	IRPM CHNG	IDLE RPM CHANGE (LEAKS ELIMINATED)
50	C	16	NONE	-1.	NOX CNTRL	NO_X CONTROL DEVICE (NONE = -1., OK = 0., NG = 1.)
51	C	17	NONE	-1.	TIMG RETRD	TIMING RETARD MECHANISM (NONE = -1., OK = 0., NG = 1.)
52	D	1-2	7,8	7.5	RQ VOLT D1	PLUG REQUIRED VOLTAGE, KV, 49/45 MPH CRUISE
53	D	3	0	0	MISFIRE D1	MISFIRE RATE, %, 49/45 MPH CRUISE
54	D	4	1.2	1.2	AIR CLN D1	AIR CLEANER RESTRICTION, IN. H_2O, 49/45 MPH CRUISE
55	D	5	.7	3.626	PCV FLO D1	PCV FLOW, FT^3/MIN, 49/45 MPH CRUISE
56	D	6-7	5,6	5.5	RQ VOLT D2	PLUG REQUIRED VOLTAGE, KV, 33.5/30 MPH CRUISE
57	D	8	0	0	MISFIRE D2	MISFIRE RATE, %, 33.5/30 MPH CRUISE
58	D	9	.3	.3	AIR CLN D2	AIR CLEANER RESTRICTION, IN. H_2O, 33.5/30 MPH CRUISE
59	D	10	.95	4.921	PCV FLO D2	PCV FLOW, FT^3/MIN, 33.5/30 MPH CRUISE
60	D	11-12	8,9	8.5	RQ VOLT D3	PLUG REQUIRED VOLTAGE, KV, IDLE
61	D	13	0	0	MISFIRE D3	MISFIRE RATE, %, IDLE
62	A	18	T	8.	GASOLINE	GASOLINE BRAND CODE (ARCO = A = 1., CHEVRON = C=2., ENCO = E = 3., GULF = G =4., MOBIL = M = 5., PHILLIPS = P = 6., SHELL = S = 7., TEXACO = T = 8., UNION = U = 9., MISCELLANEOUS = 10.)
63	B	1-2	9,12	3.	VOLT RANGE	REQUIRED VOLTAGE AT 1500 RPM, MEASURED, KV (VALUE STORED IS RANGE) (SEE ALSO WORD 16 FOR MEAN)

TABLE 2.5 (Cont'd)

B. EMISSION DATA ENTERED THRU CRC PROGRAM, TABLE OF LOCATIONS

TEST	72 COLD	72 HOT	7MODE	EPA	D1 49 (CRUISE)	D2 33 (CRUISE)	D3 (IDLE)	D4	D5	D6	75 HOT
GAS											
CO	71	72	73	74	75	76	77	78	79	80	122
CO2	81	82	83	84	85	86	87	88	89	90	123
HC	91	92	93	94	95	96	97	98	99	100	124
NOX	101	102	103	104	105	106	107	108	109	110	125
NOXP	111	112	113	114	115	116	117	118	119	120	126

WORD OR LOCATION	SOURCE		VALUE INPUT EXAMPLE	VALUE STORED EXAMPLE	TITLE	DESCRIPTION, NOTES AND CODES
	CARD	FIELD				
1	A	1	1A	1.1	TEST NO	TEST NUMBER (1A =1.1, 1B = 1.2, 5A = 5.1, 5B = 5.2)
2	A	2	0001	1.	CAR NO	CAR NUMBER (1-545 OR 1001-1260)
121	A	6	6	6.	CYLINDERS	NUMBER OF CYLINDERS

The program allows super-position of multiple sets of parameter and emission histograms. The program fundamentally develops a frequency diagram based upon any data set according to any pre-specified set of increments. Illustrations of the outputs of these programs are presented throughout the entire report.

In anticipation of the requirements for efficiently printing out of all of the data stored on file, without use of any selection criteria, the program LISTD was written. This program can provide a simple listing of all of the information stored on file or develop up to a fifth degree regression fit. Output options include tables, coefficients and pertinent statistics, data points plots, and regression curves.

2.5.2.5 Analysis Program

A series of programs were written to conduct analysis of variance with the various data sets. Since several fractional factorial experiments were conducted, separate programs were written to process each of the experiments. The programs which are titled ORTHO-XXX range from one-quarter fractional factorial to one-half fractional factorial designs which accommodate data sets from 16 to 32 samples. The programs were written to efficiently retrieve the test data stored on file and process the data according to the fractional factorial experiment performed. The cold choke parameter variations investigated as a part of the orthogonal experiment required an analysis of variance for a full factorial set. A special program was written to efficiently process the 2x3 level experiment.

2.5.2.6 Auxiliary Analysis Program

Because the time share system was used, all of the existing TRW library of auxiliary programs are readily usable to assist in the analysis of data. The SYSTEM PROGRAMS provide a large package of statistical programs. However, a special program was written to efficiently develop the curve fits of instrument calibrations. Most of the instruments follow the curve defined by Beer's law. Therefore, the program TEST CAL was written to allow systematic development of the calibration coefficients and to provide periodic checks of the coefficients with historic data.

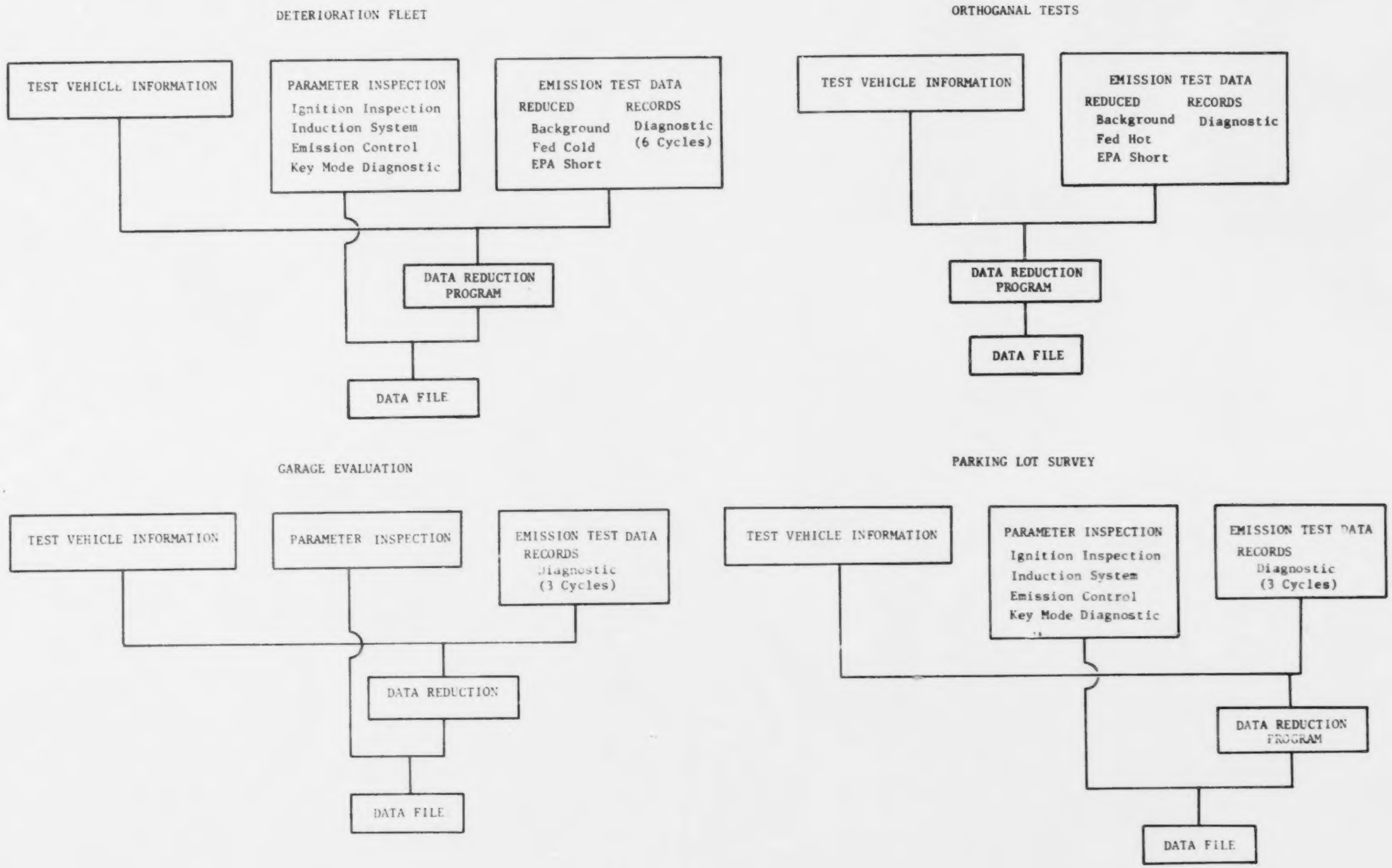
2.5.3 Data Processing System

The overall approach and the computer programs that were developed, as described in the previous sections, were applied to each experimental phase. The general flow of information for each experiment of the Extended Phase One Program is illustrated in Figure 2.13. The experiments are sufficiently different that in most cases their data sets required different handling procedures. The data however, taken in the Emission Deterioration Experiment and the Detroit Engine Parameter Survey were considered sufficiently similar to allow processing of the data in an identical manner. Although the data presented in this report do not include cases in which the information taken in Detroit was merged with the San Bernardino data, this capability does exist. Identical formats were utilized for both of the experiments and data are totally compatible for combined analysis using the auxiliary analysis programs.

The data taken in the Orthogonal Tests and the Garage Evaluation Tests were sufficiently different in data format that their analyses were handled separately. The Orthogonal Test Data was submitted to the computer and stored for ready access to the Analysis of Variance Program. Because less data were taken in these tests than in the Emission Deterioration tests, the file structures were developed separately to allow efficient processing of the Analysis of Variance. The Garage Evaluation Tests, in contrast, developed data which were sufficiently different from the other experiments so that it was necessary to process the data independently. In this case the data were primarily analyzed with minimum use of the computer.

FIGURE 2.13

DATA PROCESSING SYSTEM



DETERIORATION FLEET

ORTHOGANAL TESTS

GARAGE EVALUATION

PARKING LOT SURVEY

TEST VEHICLE INFORMATION
PARAMETER INSPECTION
Ignition Inspection
Induction System
Emission Control
Key Mode Diagnostic
EMISSION TEST DATA
REDUCED
Background
Fed Cold
EPA Short
RECORDS
Diagnostic
(6 Cycles)
DATA REDUCTION PROGRAM
DATA FILE
TEST VEHICLE INFORMATION
EMISSION TEST DATA
REDUCED
Background
Fed Hot
EPA Short
RECORDS
Diagnostic
DATA REDUCTION PROGRAM
DATA FILE
TEST VEHICLE INFORMATION
PARAMETER INSPECTION
EMISSION TEST DATA
RECORDS
Diagnostic
(3 Cycles)
DATA REDUCTION
DATA FILE
TEST VEHICLE INFORMATION
PARAMETER INSPECTION
Ignition Inspection
Induction System
Emission Control
Key Mode Diagnostic
EMISSION TEST DATA
RECORDS
Diagnostic
(3 Cycles)
DATA REDUCTION PROGRAM
DATA FILE

2.6 PRELIMINARY RESULTS

This subsection presents the preliminary results of several analyses conducted on the data taken during the first year of testing. These were:

- A characterization of vehicle population attributes
- An estimate of emission changes effected by maintenance
- A study of the effectiveness of emission signatures in diagnosing engine parameter malfunctions
- A preliminary estimate of deterioration rates
- Investigations of measurement anomolies

2.6.1 Population Attributes

Tests were conducted on 450 California vehicles which, with the exception of twenty rental vehicles, were privately owned and operated in the greater San Bernardino area. These vehicles were randomly selected from the Scott data bank of private vehicles. This section presents the characterization of the vehicle populations and their as received exhaust emissions and engine parameter states. A complete data listing, together with the statistics of all of the parameters, is presented for Test 1A in Appendix A.

2.6.1.1 Vehicle Fleet Compositions

The deterioration rates of engine parameters are being characterized for a captive fleet of 450 vehicles. The total vehicle set consisted of three vehicle fleets which represented pre-emission controlled vehicles (Fleet 1), emission controlled vehicles (Fleet 2), and NO_x controlled vehicles (Fleet 3). Therefore, as defined by California standards, the three vehicle fleets consisted respectively of 1960 to 1965 vehicles, 1966 to 1970 vehicles and 1971 vehicles. Each fleet was to be representative of vehicle makes distributed in accordance to the national population. The composition of the three fleets that were selected for the test program are depicted in Figures 2.14 to 2.16. These bar charts show the actual make/model fraction for each fleet and the numerical value of the corresponding national distribution is noted. A comparison of the experimental fleet and the national distribution for each of the vehicle

FIGURE 2.14

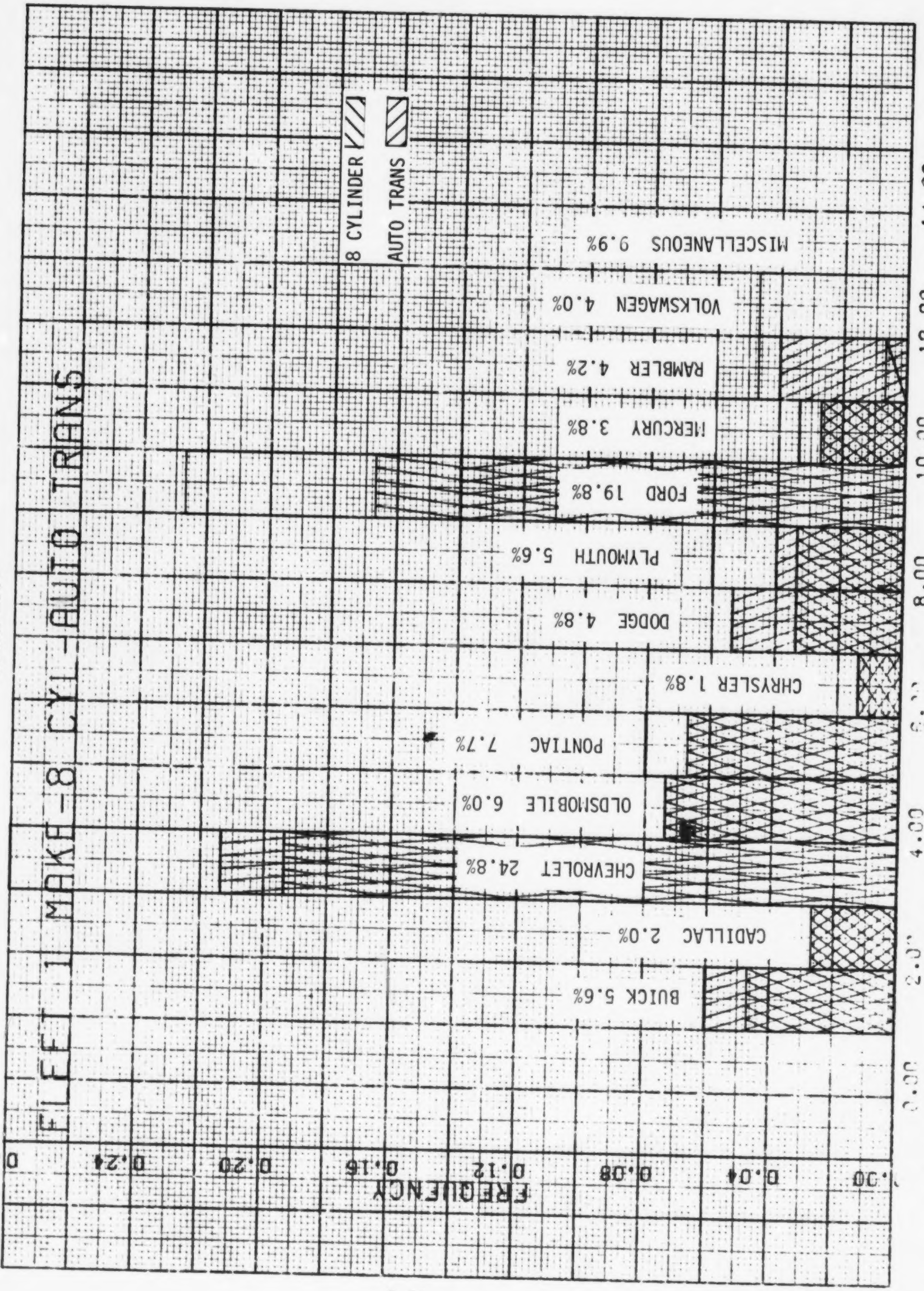

FLEET 1 MAKE-8 CYL-AUTO TRANS
8 CYLINDER ▨
AUTO TRANS ▧
BUICK 5.6%
CADILLAC 2.0%
CHEVROLET 24.8%
OLDSMOBILE 6.0%
PONTIAC 7.7%
CHRYSLER 1.8%
DODGE 4.8%
PLYMOUTH 5.6%
FORD 19.8%
MERCURY 3.8%
RAMBLER 4.2%
VOLKSWAGEN 4.0%
MISCELLANEOUS 9.9%
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.28

FIGURE 2.15

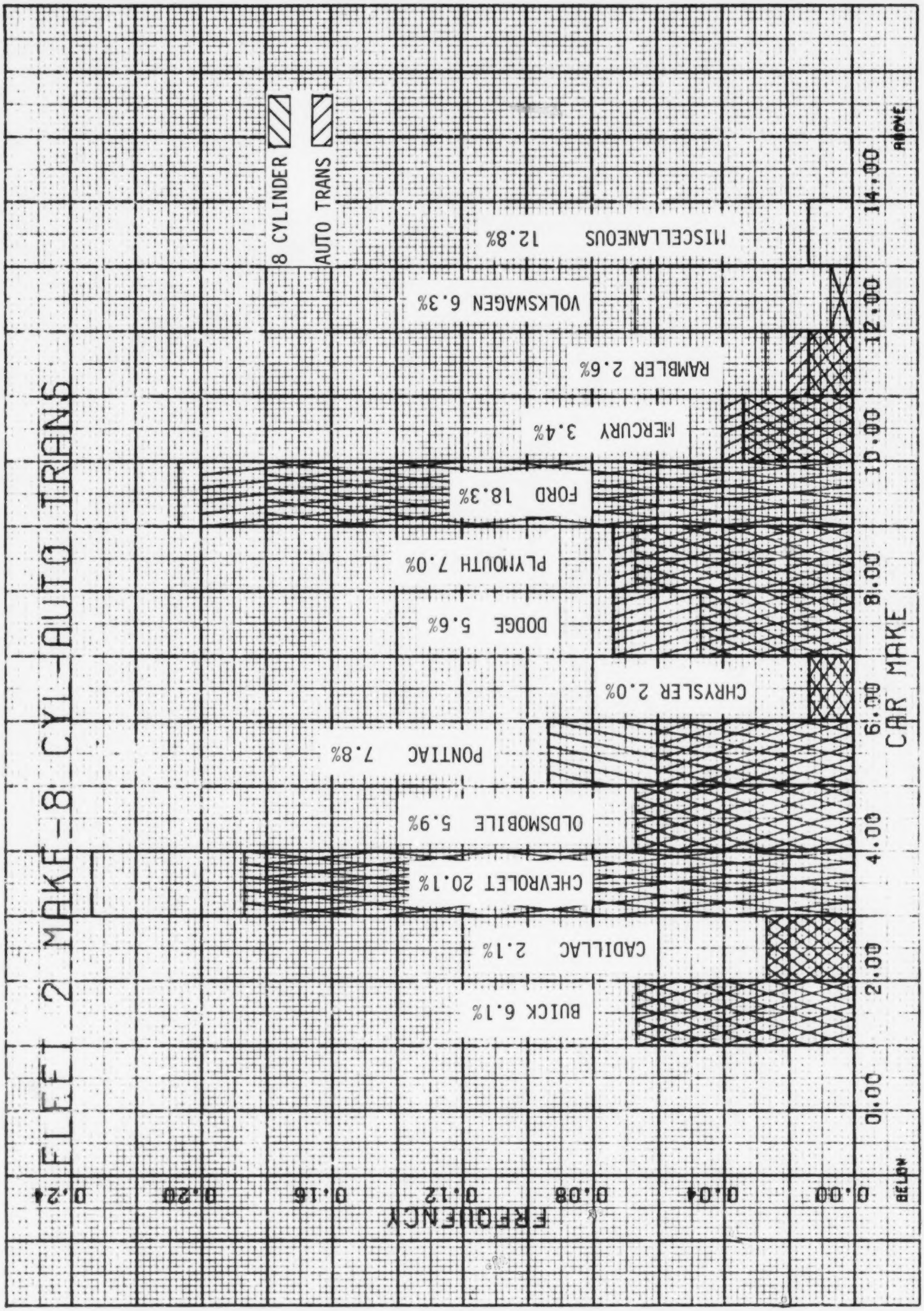
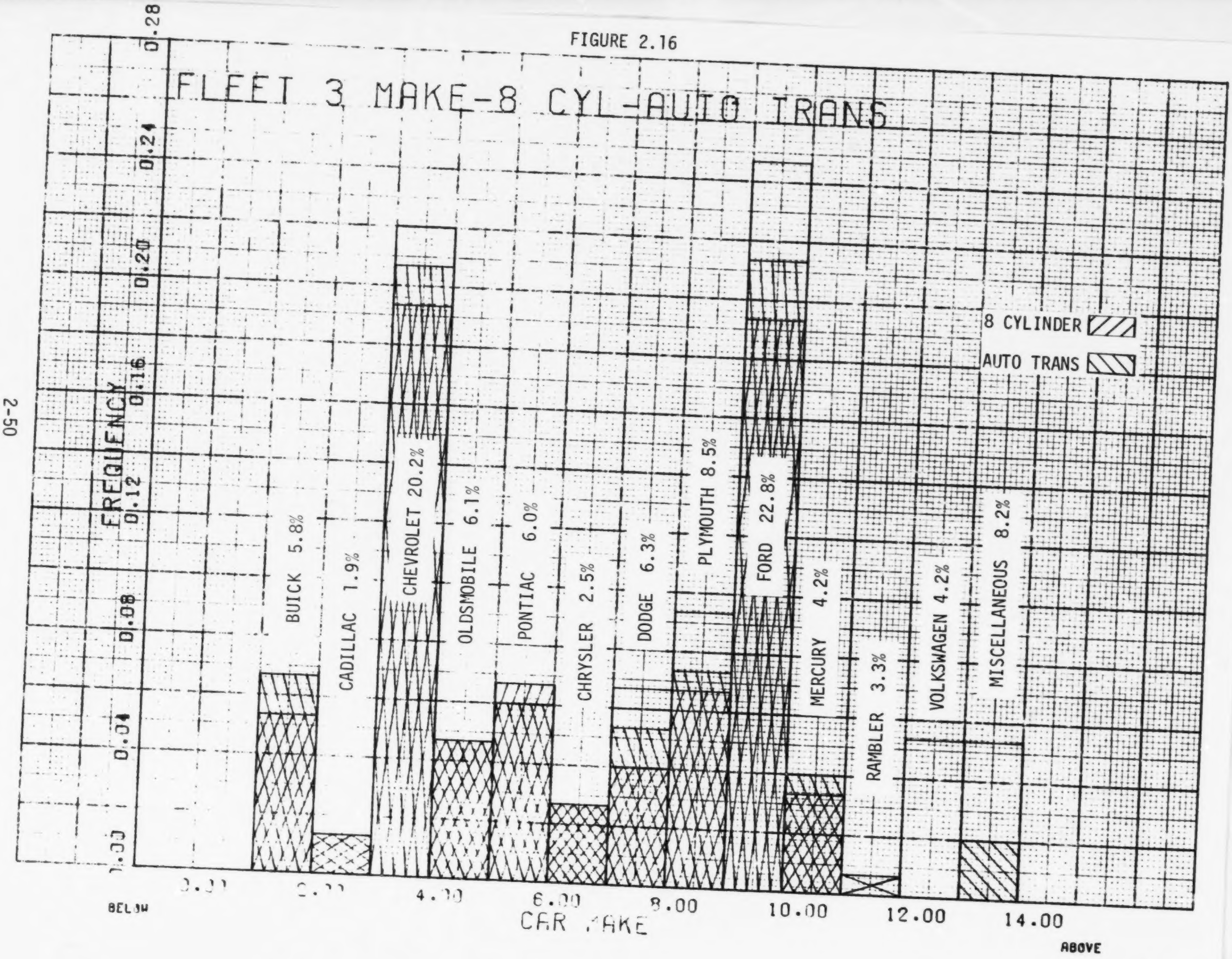

FLEET 2 MAKE-8 CYL-AUTO TRANS
8 CYLINDER
AUTO TRANS
BUICK 6.1%
CADILLAC 2.1%
CHEVROLET 20.1%
OLDSMOBILE 5.9%
PONTIAC 7.8%
CHRYSLER 2.0%
DODGE 5.6%
PLYMOUTH 7.0%
FORD 18.3%
MERCURY 3.4%
RAMBLER 2.6%
VOLKSWAGEN 6.3%
MISCELLANEOUS 12.8%
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
CAR MAKE
BELOW
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
ABOVE

FIGURE 2.16


FLEET 3 MAKE-8 CYL-AUTO TRANS
8 CYLINDER ▨
AUTO TRANS ▧
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.28
BUICK 5.8%
CADILLAC 1.9%
CHEVROLET 20.2%
OLDSMOBILE 6.1%
PONTIAC 6.0%
CHRYSLER 2.5%
DODGE 6.3%
PLYMOUTH 8.5%
FORD 22.8%
MERCURY 4.2%
RAMBLER 3.3%
VOLKSWAGEN 4.2%
MISCELLANEOUS 8.2%
BELOW
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
ABOVE
CAR MAKE

makes indicates a high degree of compliance of the selected vehicles to the national population. There was, however, one predominant area of discrepancy. The vehicle fractions that represent the miscellaneous category were significantly low in all fleets.

The distribution of engine configuration and automatic transmissions are shown with cross-hatching. The fraction of vehicles that have eight cylinder engines is indicated by shaded lines with a positive slope. The fraction which represents vehicles with automatic transmissions is indicated by shaded lines with a negative slope.

2.6.1.2 Emission Distributions

All of the vehicles were emission tested prior to the engine parameter initialization process. The vehicles were tested using the 1972 Federal CVS Procedure, 7-Mode CVS Procedure, Federal Short Procedure, and three modes of the Clayton keymode cycles (49/45 MPH Cruise, 33/30 MPH Cruise and Idle). Histograms representing each emission measurement using the six procedures or modes, together with the individual data points, are presented in Appendix A. To illustrate the shape of the distributions, histograms of the emissions (HC, CO and NO_x) measured using the 1972 Federal CVS Procedure for each of the vehicle fleets are presented in Figures 2-17 through 2-25. Since most of the statistical comparisons and significant statements are made on the basis of an assumed normal distribution or the student "t" distribution, the assessment of the validity of the statistical statements can be made by reviewing the graphical illustrations. In general, an assumption of a normal distribution is reasonable. The only variable which appears to greatly deviate from a normal distribution is the carbon monoxide emissions. A log-normal distribution would more closely represent carbon monoxide emissions data. However, the use of the normal distribution will usually result in conservative estimates when applying statistical tests. For input to the economic effectiveness program, the empirically developed histograms were used. The statistics associated with the normal distribution of the more salient parameters are presented in Table 2.6. This table was constructed to allow a direct comparison of the distribution of emissions and engine parameters of vehicles tested in San Bernardino with vehicles tested in Detroit. A

FIGURE 2.17

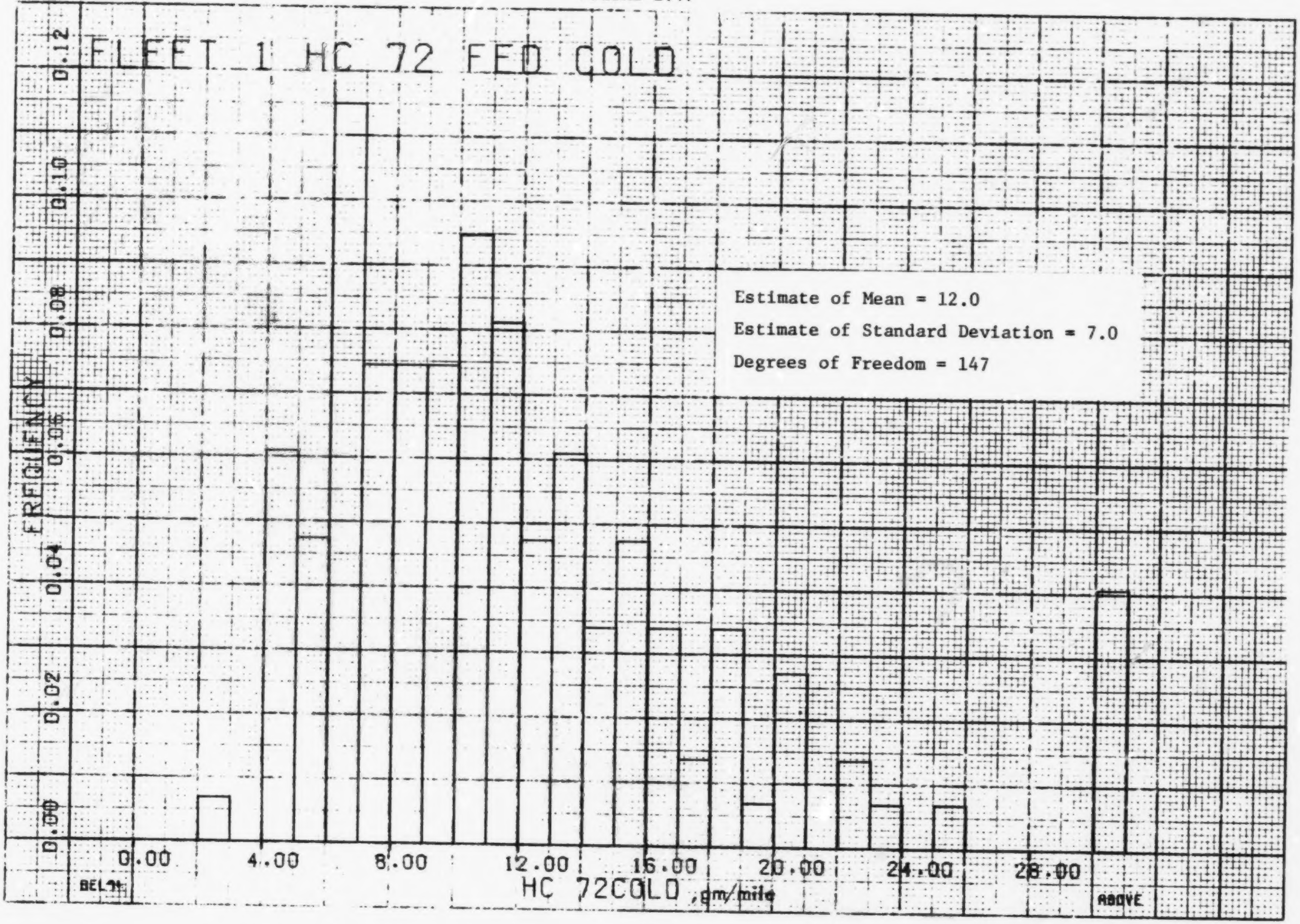

FLEET 1 HC 72 FED COLD
Estimate of Mean = 12.0
Estimate of Standard Deviation = 7.0
Degrees of Freedom = 147
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
BELOW
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
ABOVE
HC 72COLD ,gm/mile

FIGURE 2.18

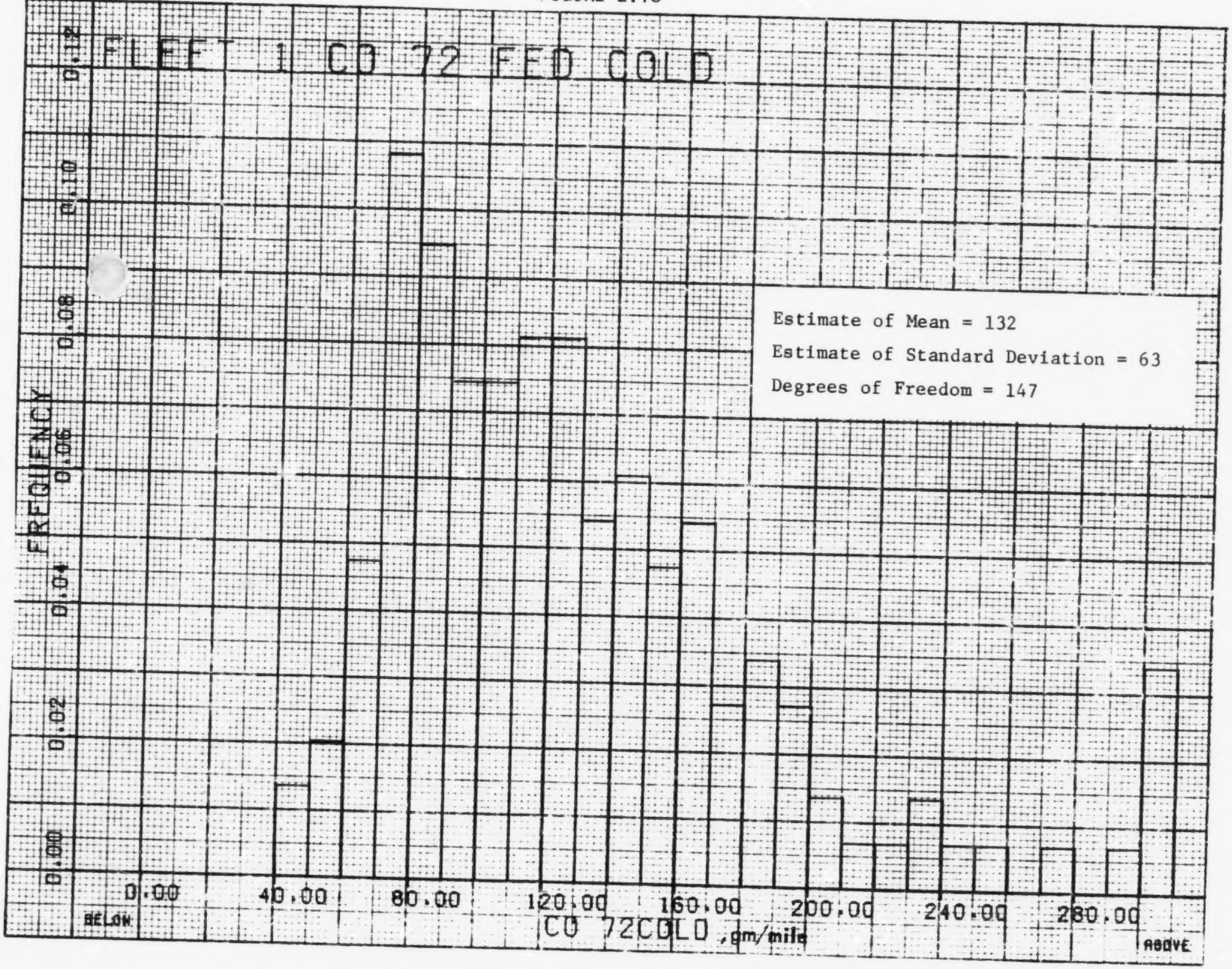
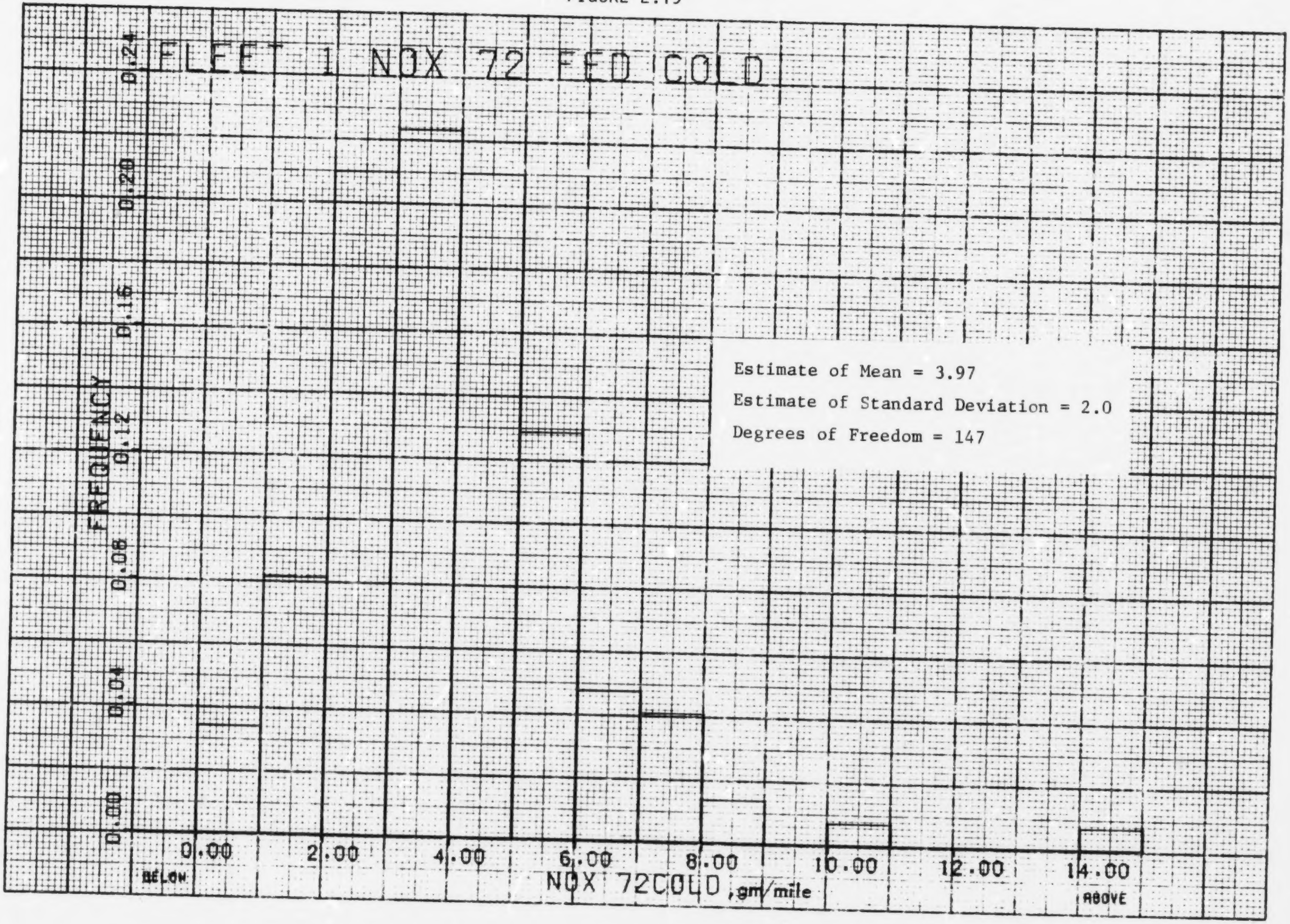

Estimate of Mean = 132
Estimate of Standard Deviation = 63
Degrees of Freedom = 147

FIGURE 2.19

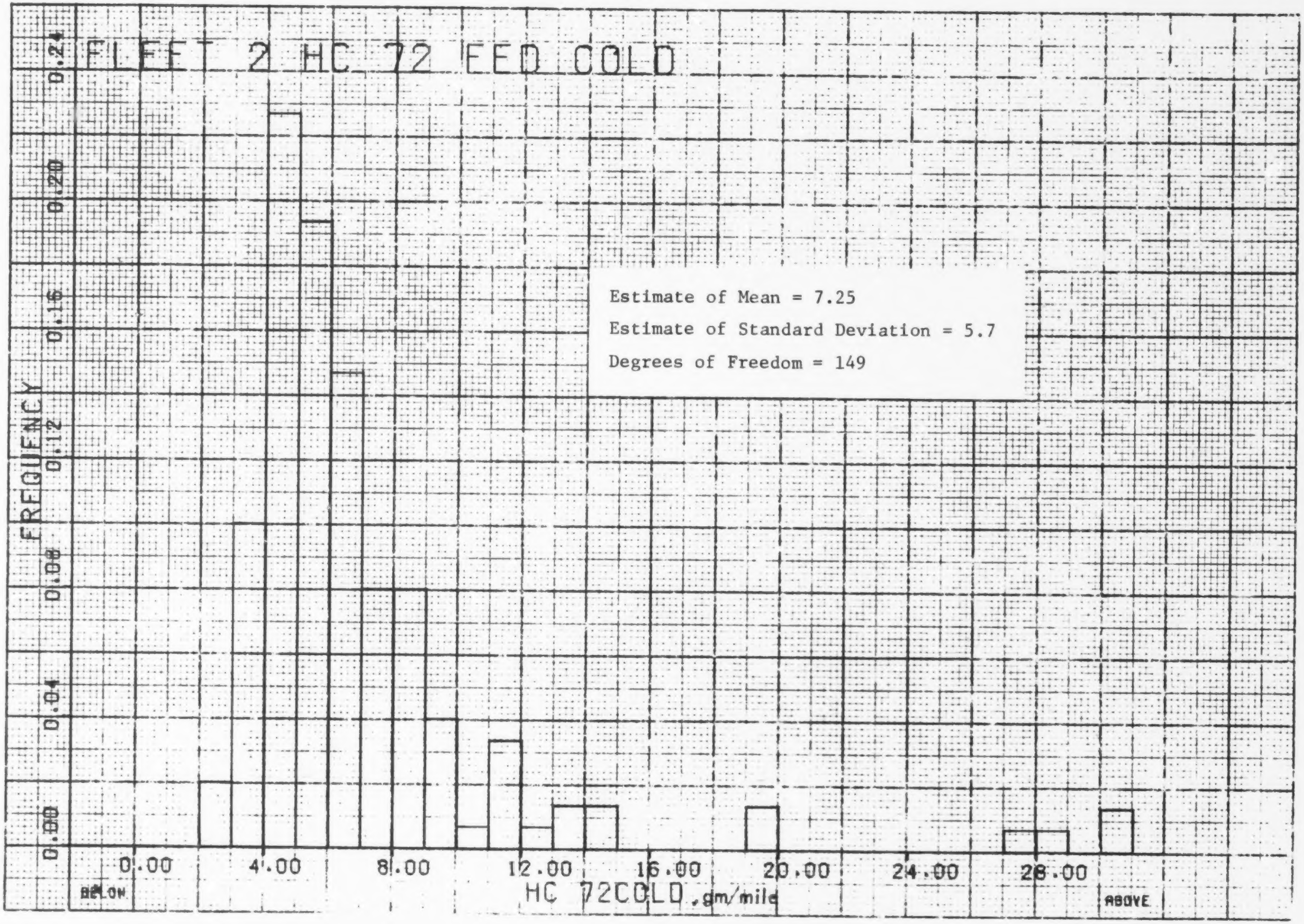


Estimate of Mean = 3.97

Estimate of Standard Deviation = 2.0

Degrees of Freedom = 147

FIGURE 2.20

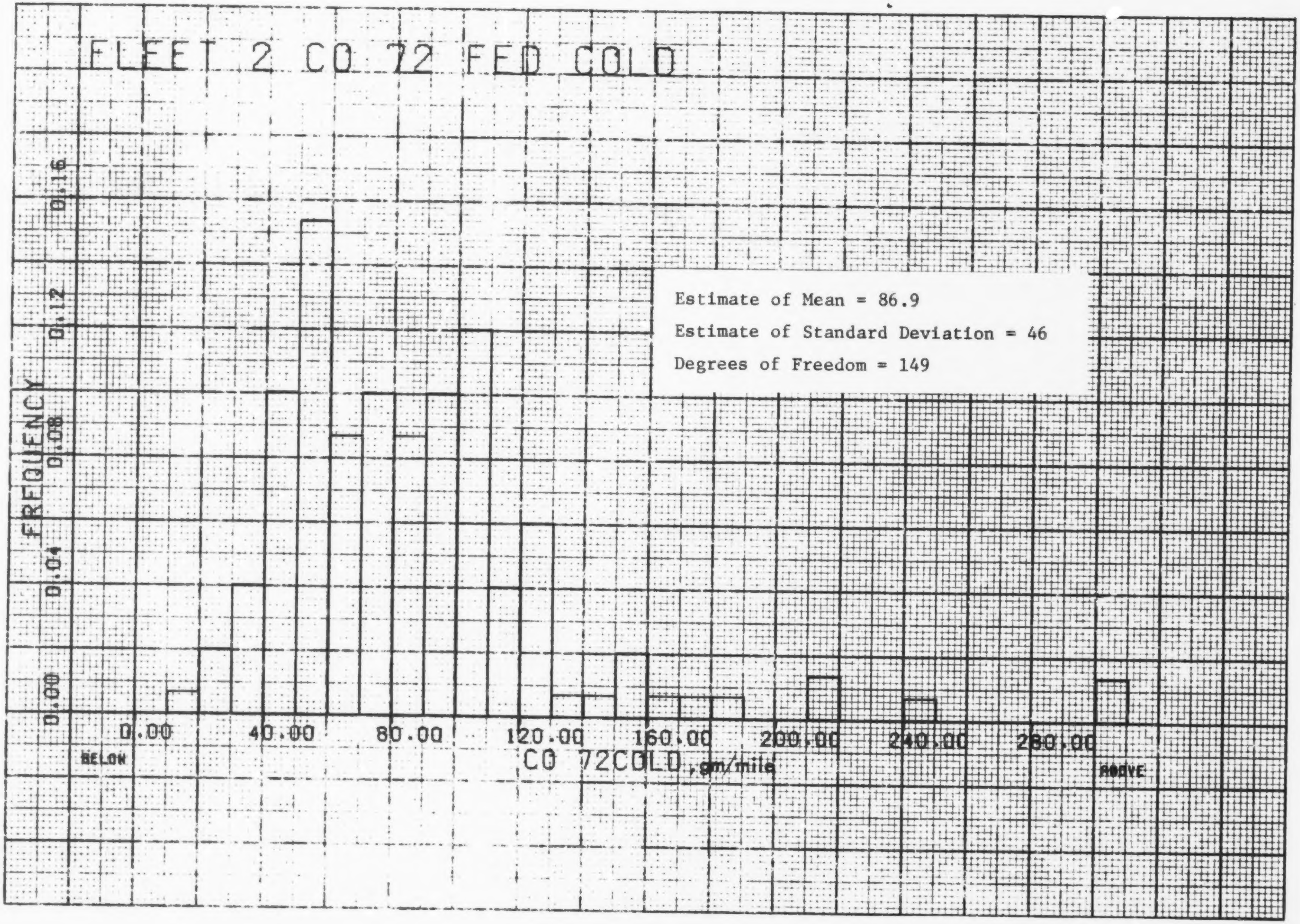


Estimate of Mean = 7.25

Estimate of Standard Deviation = 5.7

Degrees of Freedom = 149

FIGURE 2.21

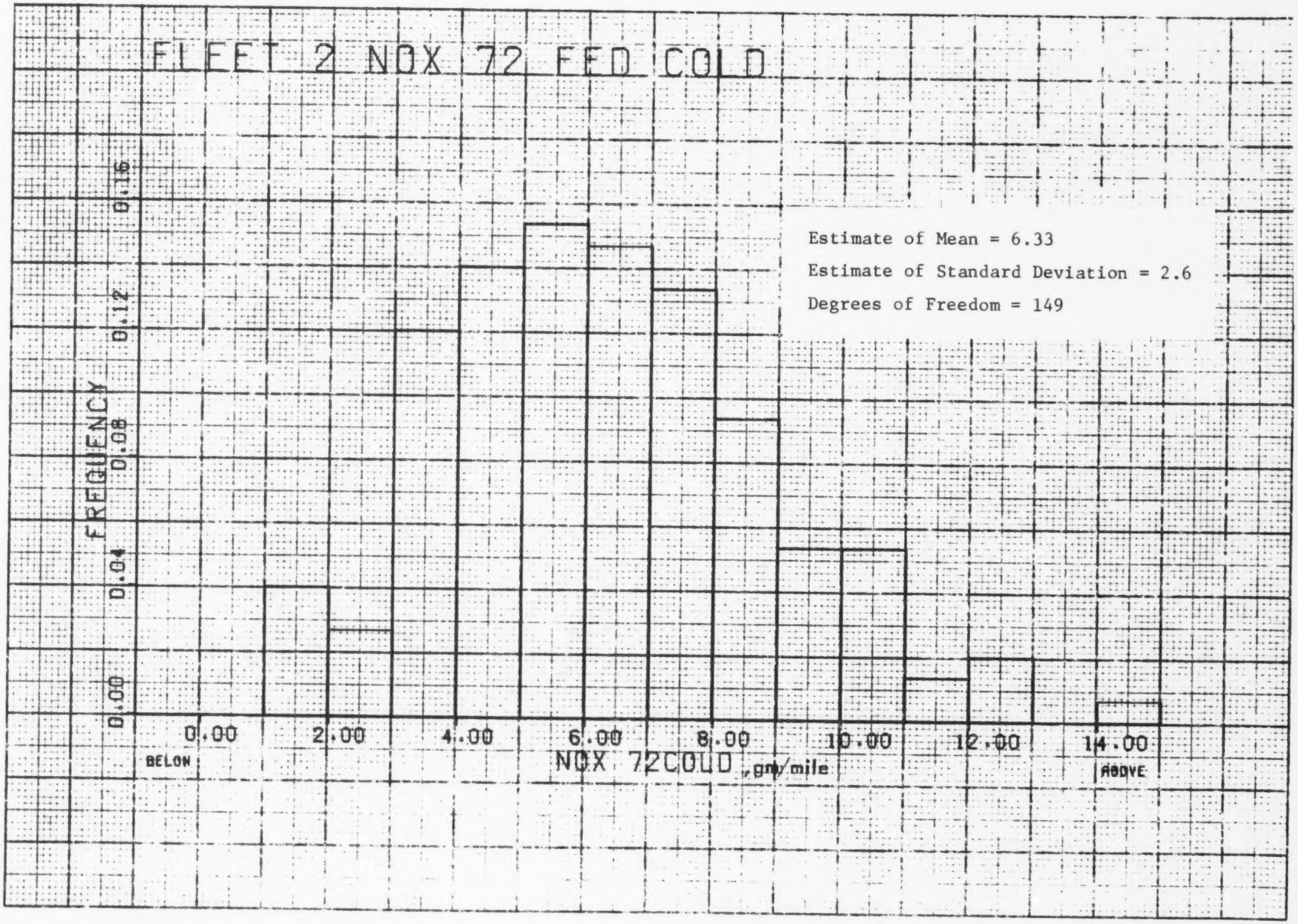


Estimate of Mean = 86.9

Estimate of Standard Deviation = 46

Degrees of Freedom = 149

FIGURE 2.22

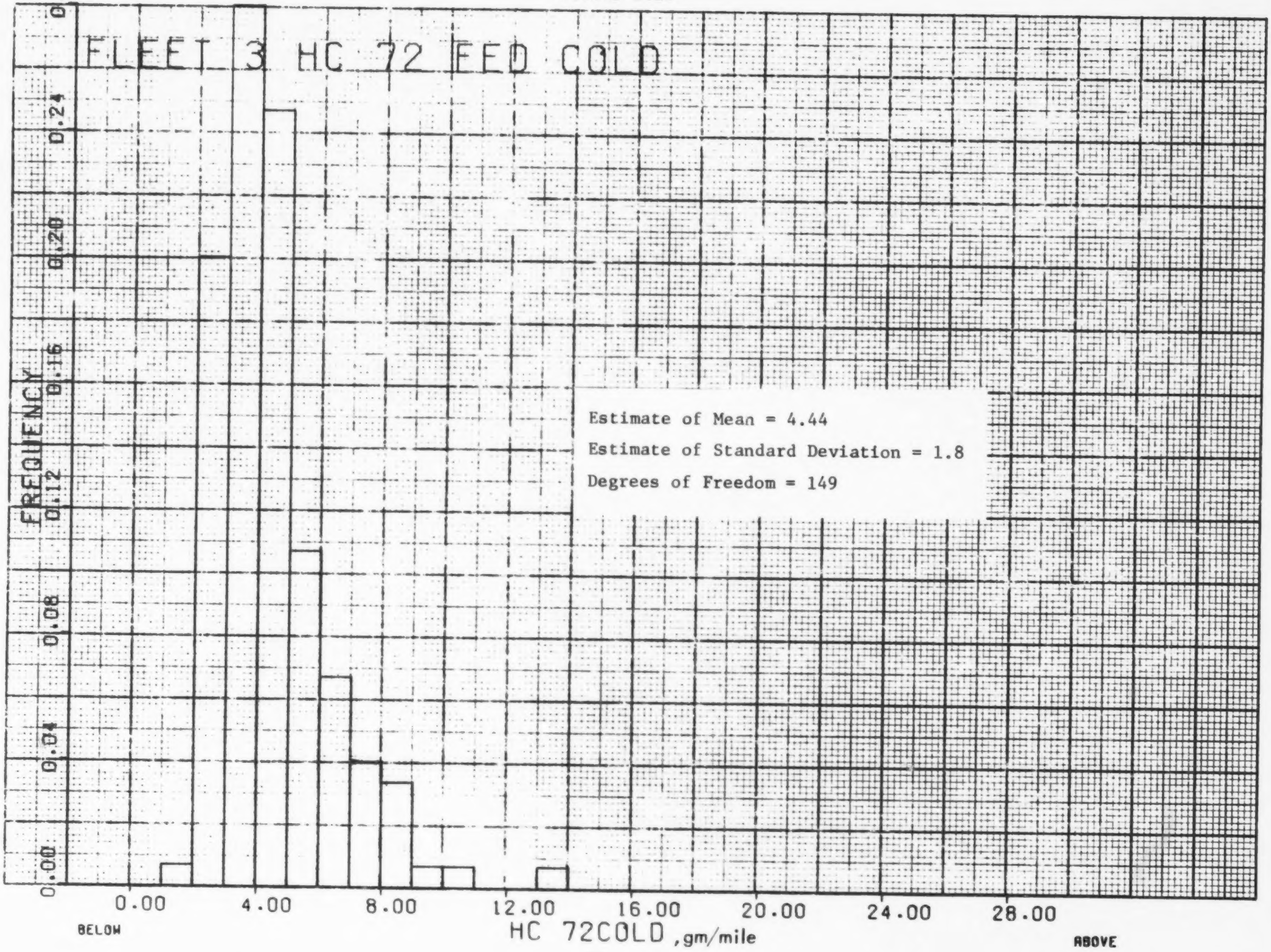


Estimate of Mean = 6.33

Estimate of Standard Deviation = 2.6

Degrees of Freedom = 149

FIGURE 2.23

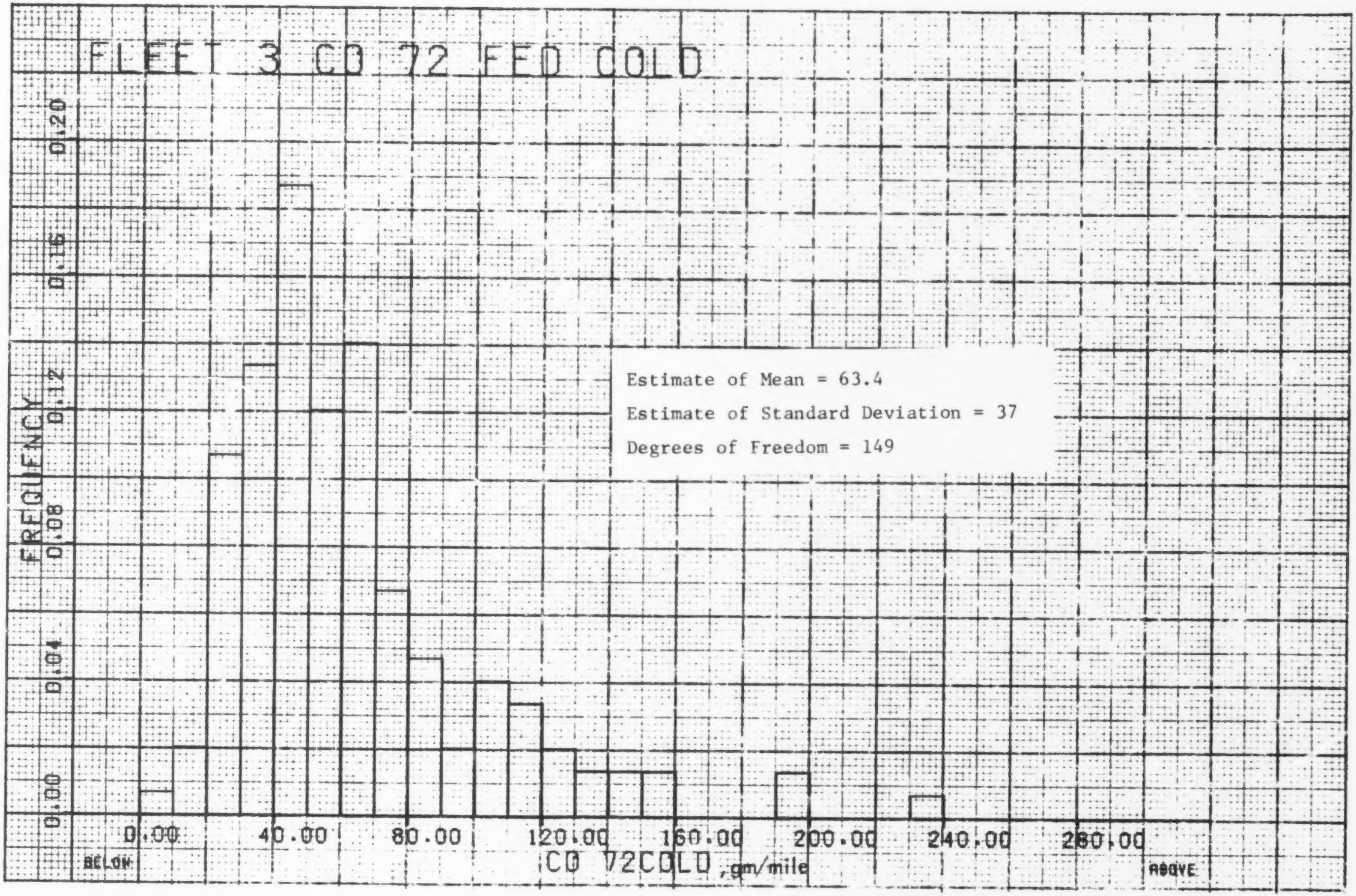


Estimate of Mean = 4.44

Estimate of Standard Deviation = 1.8

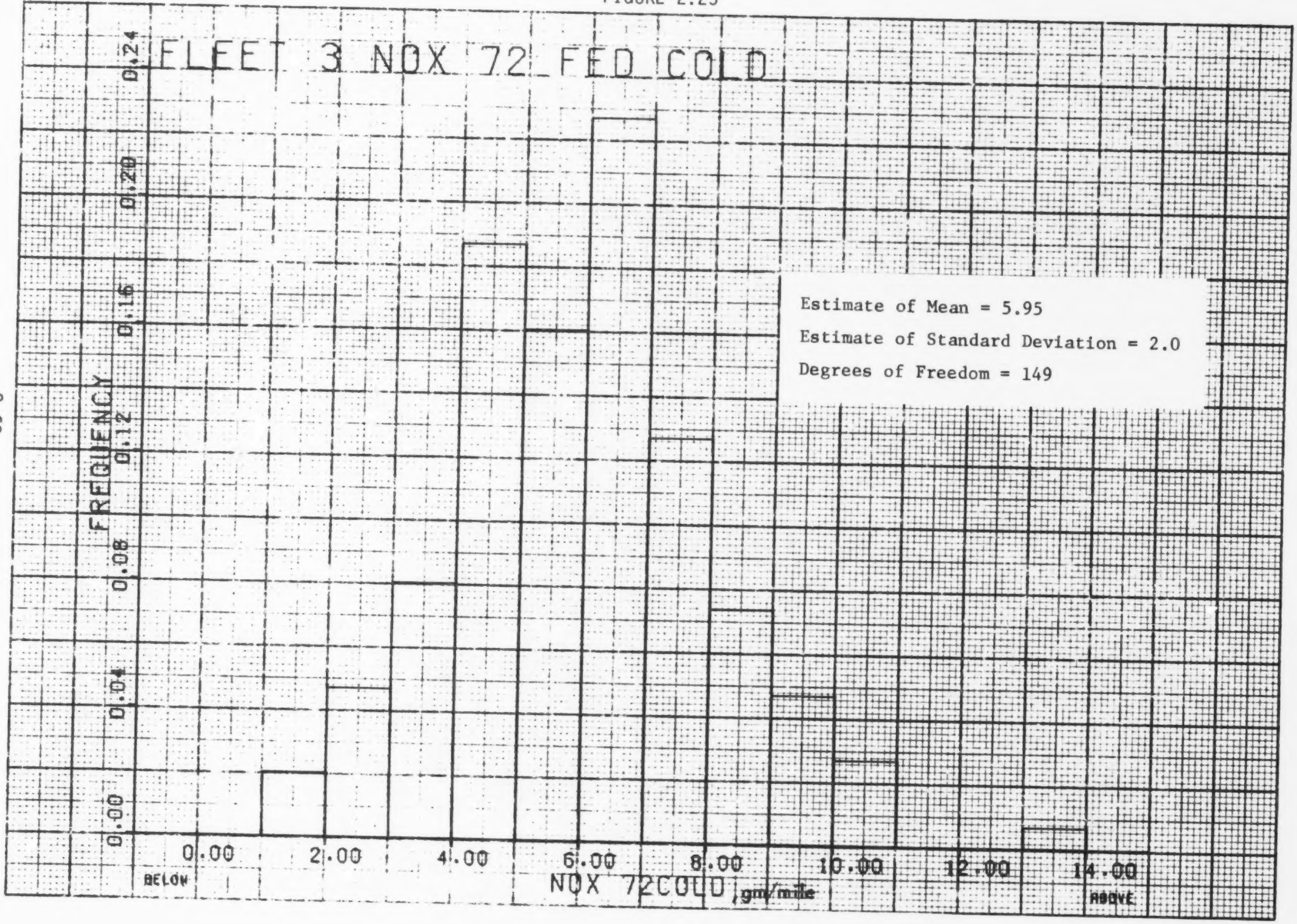
Degrees of Freedom = 149

FIGURE 2.24



Estimate of Mean = 63.4
Estimate of Standard Deviation = 37
Degrees of Freedom = 149

FIGURE 2.25



Estimate of Mean = 5.95

Estimate of Standard Deviation = 2.0

Degrees of Freedom = 149

TABLE 2.6
COMPARISON OF SAN BERNARDINO & DETROIT AS RECEIVED EMISSION & ENGINE PARAMETER DISTRIBUTIONS

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES							EMISSION CONTROLLED VEHICLES							NOX CONTROLLED VEHICLES		
	SAN BERNARDINO (1960-1965)			DETROIT (1960-1967)				SAN BERNARDINO (1966-1970)			DETROIT (1968-1971)				SAN BERNARDINO (1971)		
	$\bar{X}$	S	d.f.	$\bar{X}$	S	d.f.	t	$\bar{X}$	S	d.f.	$\bar{X}$	S	d.f.	t	$\bar{X}$	S	d.f.
HC 72 COLD, g/mile	12.00	7.0	147	-	-	-	-	7.25	5.7	149	-	-	-	-	4.44	1.8	149
CO 72 COLD, g/mile	131.5	63	147	-	-	-	-	86.9	46	149	-	-	-	-	63.4	37	149
NOX 72 COLD, g/mile	3.97	2.0	147	-	-	-	-	6.33	2.6	149	-	-	-	-	5.95	2.0	149
HC D1 (49/45), ppm	383	450	147	332	374	129	1.02	222	306	148	198	107	128	0.84	135	56	149
CO D1 (49/45), % v	3.43	2.6	147	1.64	1.5	129	7.13*	1.22	1.3	149	0.69	0.81	128	4.03*	0.87	1.16	149
NOX D1 (49/45), ppm	1666	864	147	-	-	-	-	2613	976	149	-	-	-	-	2537	740	149
HC D3 (Idle), ppm	865	989	146	603	582	128	2.64*	376	546	148	300	230	128	1.55	240	199	149
CO D3 (Idle), % v	6.08	3.0	147	4.50	3.1	129	4.41*	4.09	2.6	149	3.15	2.5	128	3.08*	3.34	2.7	149
NOX D3 (Idle), ppm	126.8	122	147	-	-	-	-	124.2	82	149	-	-	-	-	168	96	149
TIMING, degrees (DV)	0.35	5.7	148	0.62	6.0	123	-0.38	0.50	4.6	149	1.07	3.7	124	-1.11	0.17	3.4	147
IRPM, rpm (DV)	77.9	137	148	108.5	146	129	-1.81	-18.2	108	149	2.5	90	126	-1.72	-5.68	138	149
AIR CLN ANGLE, degrees	60.0	53	137	61.7	45	113	-0.27	45.6	53	137	47	44	117	-0.23	28.8	43	130
PCV FLO D1, cfm	2.87	1.3	126	2.86	1.3	87	0.05	2.62	0.97	138	2.85	1.2	118	-1.71	2.58	0.90	135
CHOKE KICK, in (DV)	$9.24\text{x}10^{-3}$	$4.88\text{x}10^{-2}$	79	-.0511	0.0654	97	6.85	$-4.42\text{x}10^{-3}$	$4.6\text{x}10^{-2}$	122	-.0372	0.0643	98	4.43*	$-9.56\text{x}10^{-3}$	$4.06\text{x}10^{-2}$	126
HEAT RISER, % failed	53.1	-	80	68.0	-	77	-	44.0	-	74	42.5	-	65	-	3.4	-	29
VACUUM DIAPH, % failed	25.0	-	27	32.6	-	42	-	21.7	-	91	21.3	-	79	-	0.0	-	123
MISFIRE D1, %	12.3	11.3	6	14.5	1.8	4	-0.51	2.6	0.4	2	4.7	0.4	1	-5.75	-	-	-
MISFIRE D2, %	14.4	9.6	6	15.1	1.7	4	-0.18	4.6	3.6	2	4.8	2.4	1	-0.07	-	-	-
MISFIRE D3, %	17.5	12.0	6	13.9	3.8	4	0.74	11.5	9.7	2	4.2	0.9	1	1.30	-	-	-
AIR PUMP, % failed	-	-	-	-	-	-	-	8.1	-	37	-	-	-	-	-	-	-
NOX CONTROL, % failed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.9	-	81
MILEAGE, miles	83358	26047	148	58280	19377	129	-	43786	20567	148	27863	17340	128	-	8059	6451	149

*Estimates of means significantly different (confidence equal to or gr*ater than 90%).

further discussion of the comparison is presented in Section 4. This table is duplicated in Section 4 for ease of reference.

2.6.1.3 Parameter Distributions

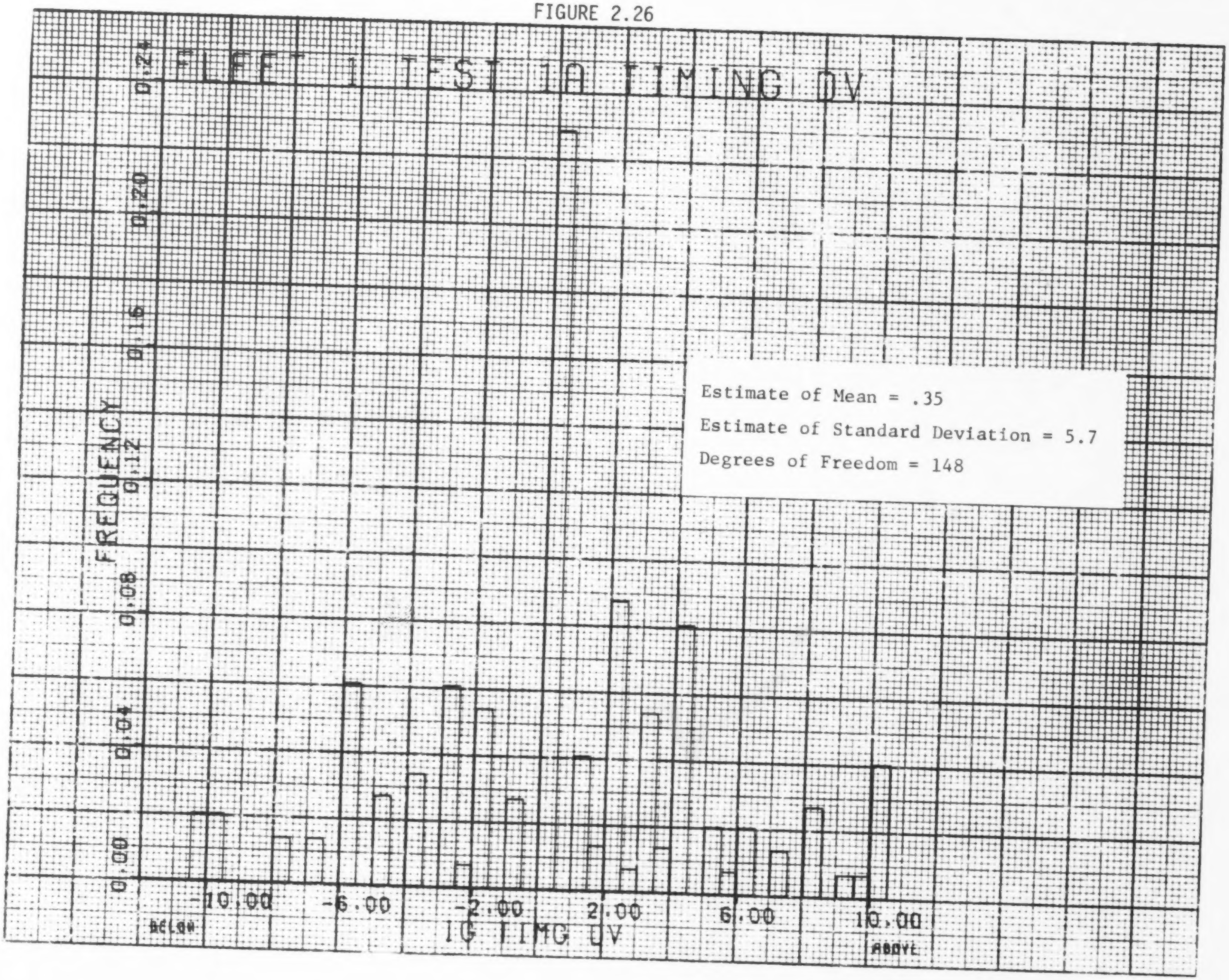
All of the vehicles selected for the deterioration experiment were inspected prior to initialization. Quantitative measurements were made using conventional and new diagnostic equipment and procedures. The distributions are representative of vehicle populations in varying maintenance states. Some vehicles have been driven extensively since their last engine tune-up, whereas others were very recently maintained. In particular, the NO_x emission control vehicles, which were 1971 models, were in most cases in fairly good condition. The statistics, assuming normal distributions, are presented in Table 2.6. Histograms of engine parameters were developed as a part of the emission signature study (Section 2.6.3) and are presented in this discussion to illustrate the actual measured distributions of the variables.

The distributions of the basic timing, given in terms of the deviation in degrees from their specification values, are presented in Figures 2.26 to 2.28. A positive value indicates advanced timing. These figures show that a significantly large number of vehicles have timing deviations greater than 0.5 degrees. The distributions in all cases show a substantial fraction of the sample at the zero deviation point. The distributions around the specification value are normally distributed.

The distribution of the idle speed for the three fleets is presented in Figures 2.29 through 2.31. The frequency distributions were developed in terms of the measured Idle RPM deviation from the listed specification value. A positive value of Idle RPM therefore represents an idle speed greater than the specification value. These distributions are fairly continuous and, as expected, slightly skewed in a negative direction.

In contrast to all of the other distributions, the distributions of Air Cleaner Angle measured in degrees, show a higher degree of skewness. The distributions of the measured air cleaner angle for each of the three fleets are presented in Figures 2.32 through 2.34. The air cleaner angle is a measure of air cleaner restriction and therefore, would be expected

FIGURE 2.26

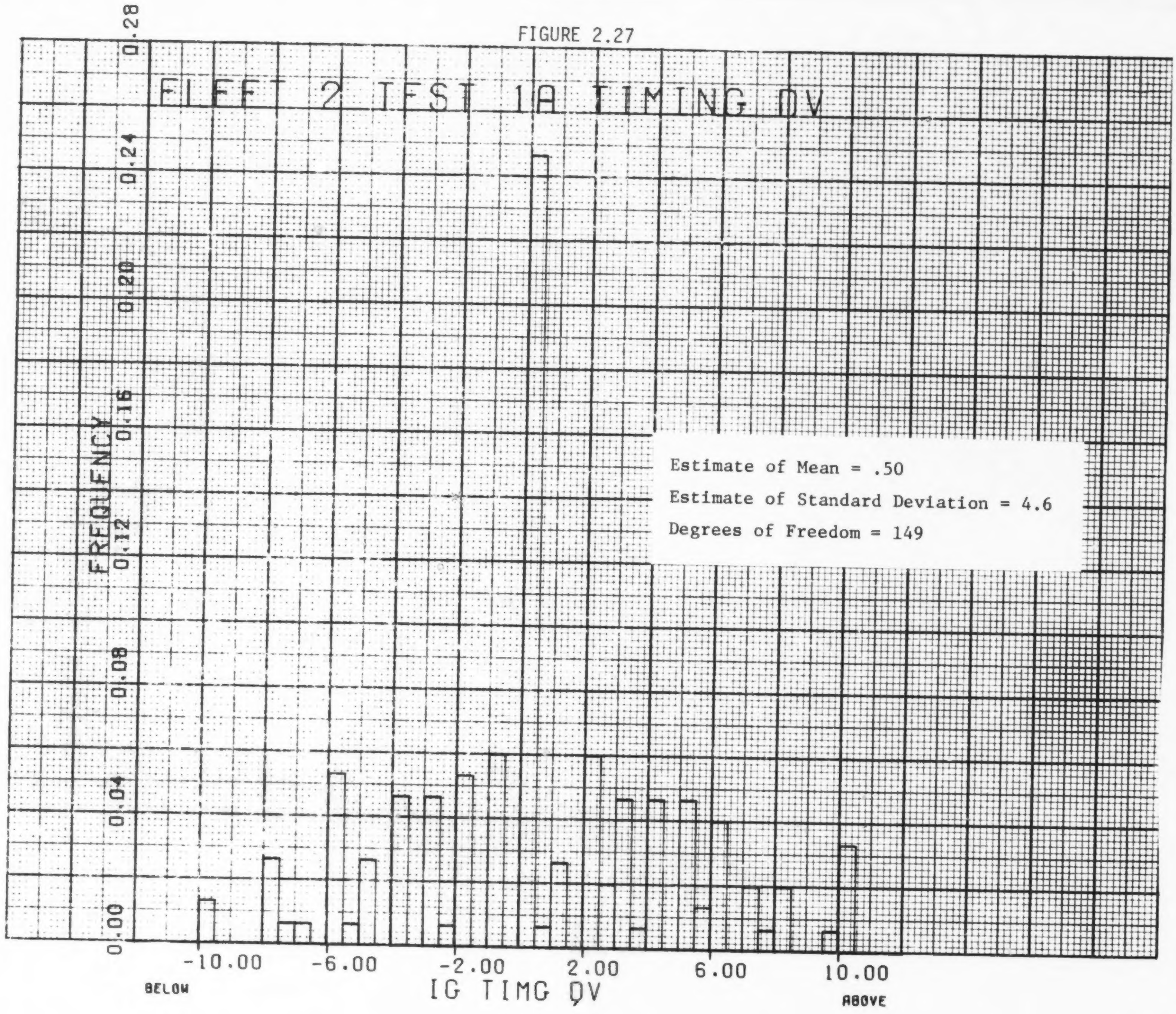


Estimate of Mean = .35

Estimate of Standard Deviation = 5.7

Degrees of Freedom = 148

FIGURE 2.27

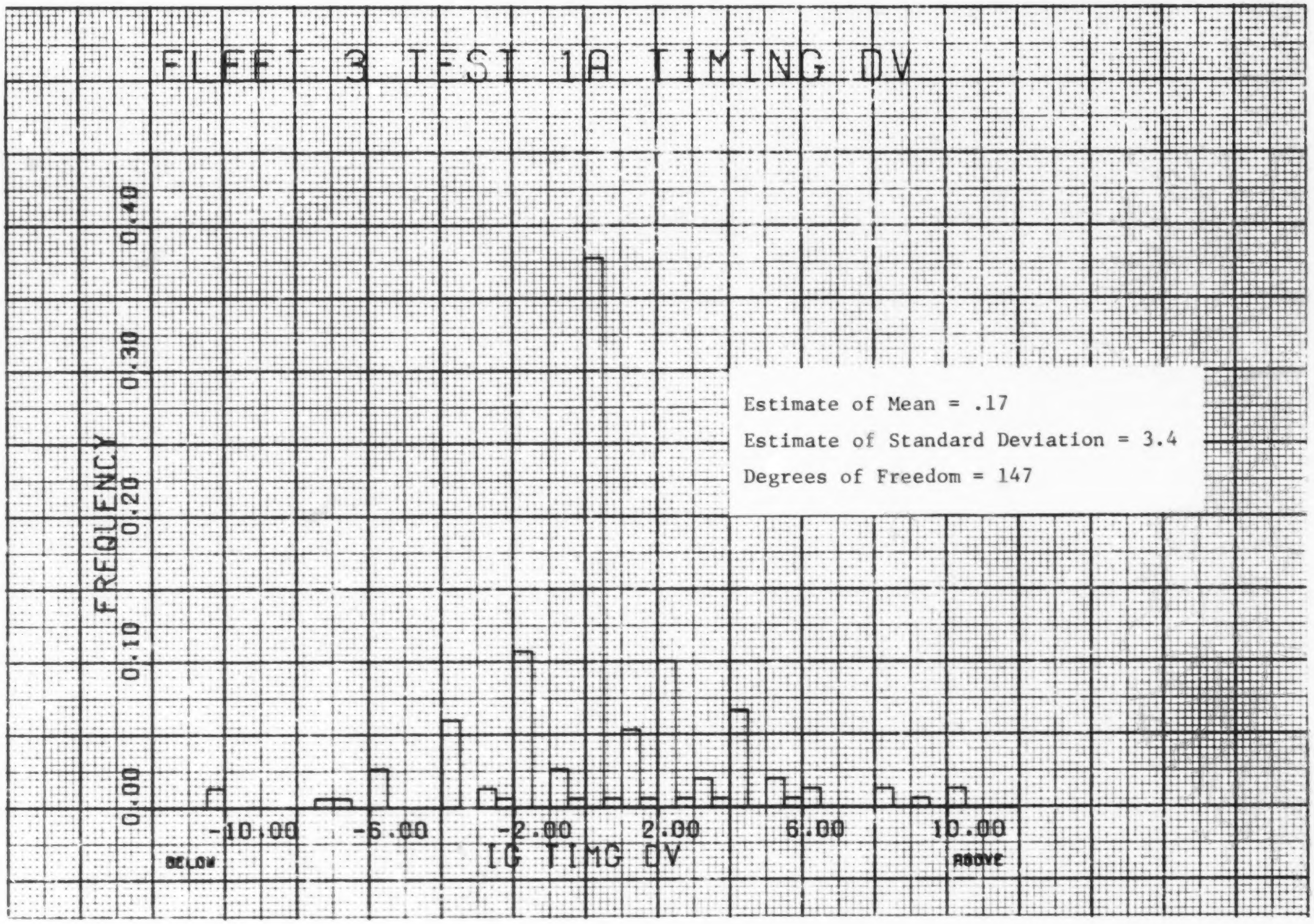


Estimate of Mean = .50

Estimate of Standard Deviation = 4.6

Degrees of Freedom = 149

FIGURE 2.28

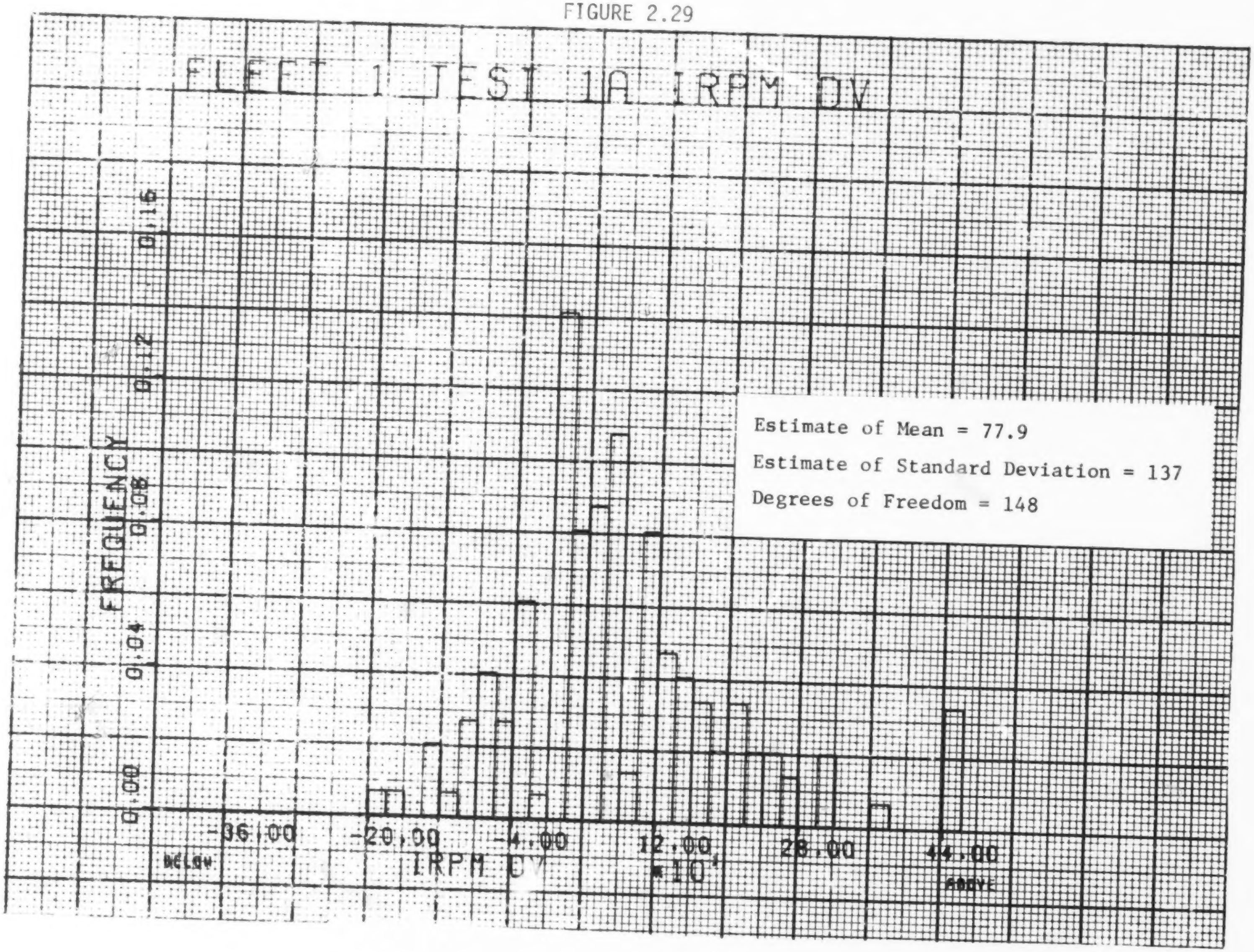


Estimate of Mean = .17

Estimate of Standard Deviation = 3.4

Degrees of Freedom = 147

FIGURE 2.29



Estimate of Mean = 77.9

Estimate of Standard Deviation = 137

Degrees of Freedom = 148

FIGURE 2.30

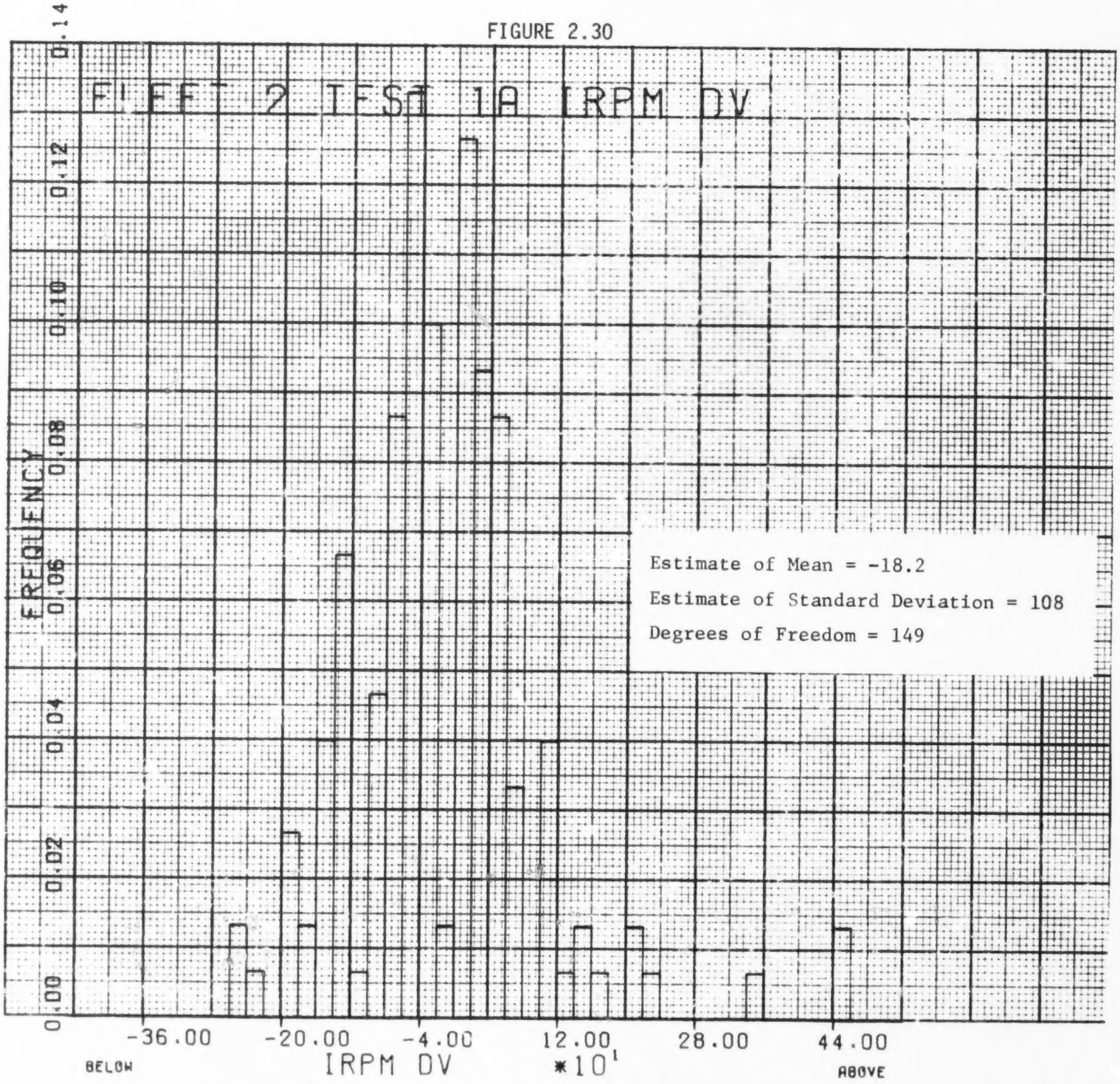
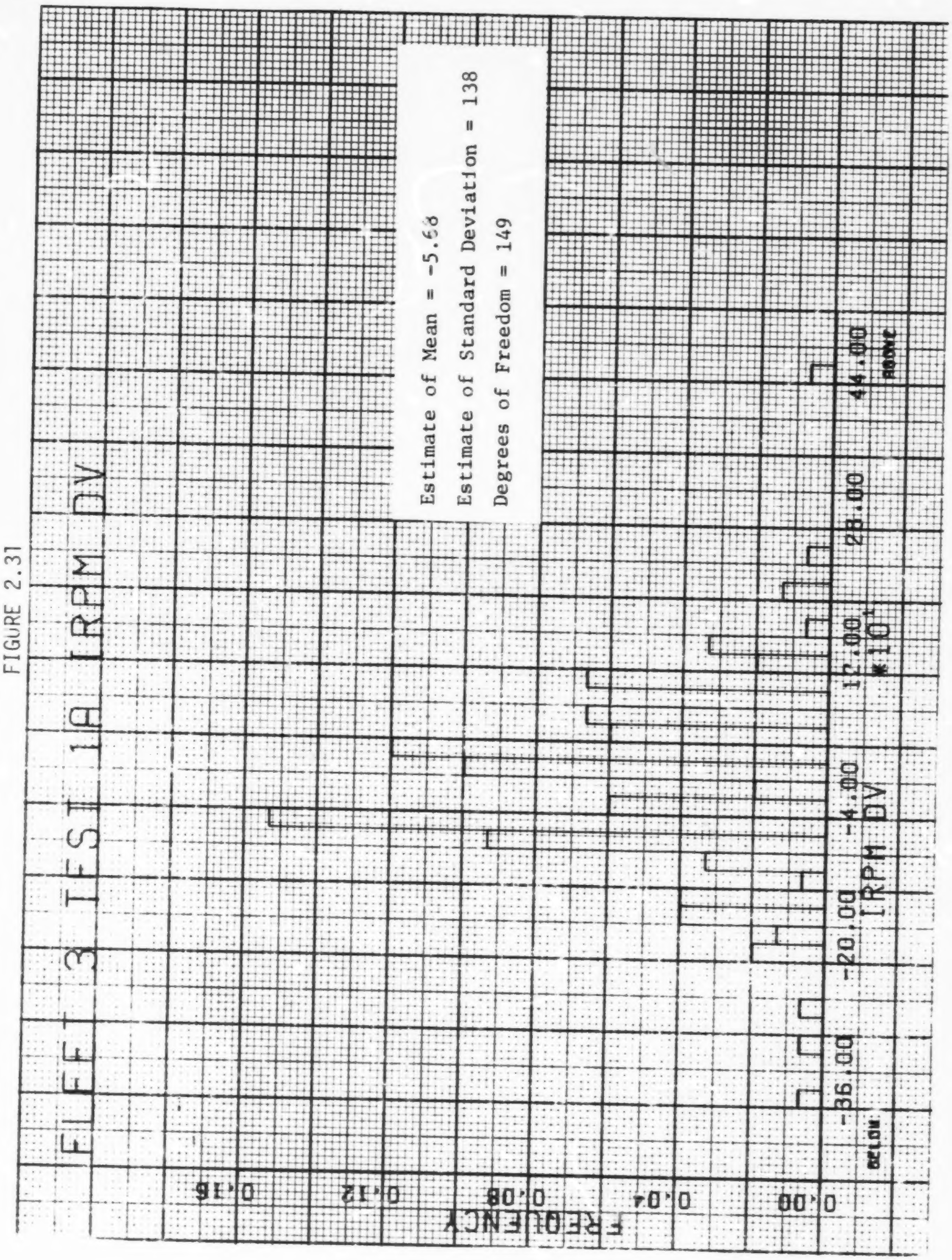

FLEET 2 TEST 1A IRPM DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
-36.00
-20.00
-4.00
12.00
28.00
44.00
BELOW
ABOVE
IRPM DV
*10¹
Estimate of Mean = -18.2
Estimate of Standard Deviation = 108
Degrees of Freedom = 149

FIGURE 2.31

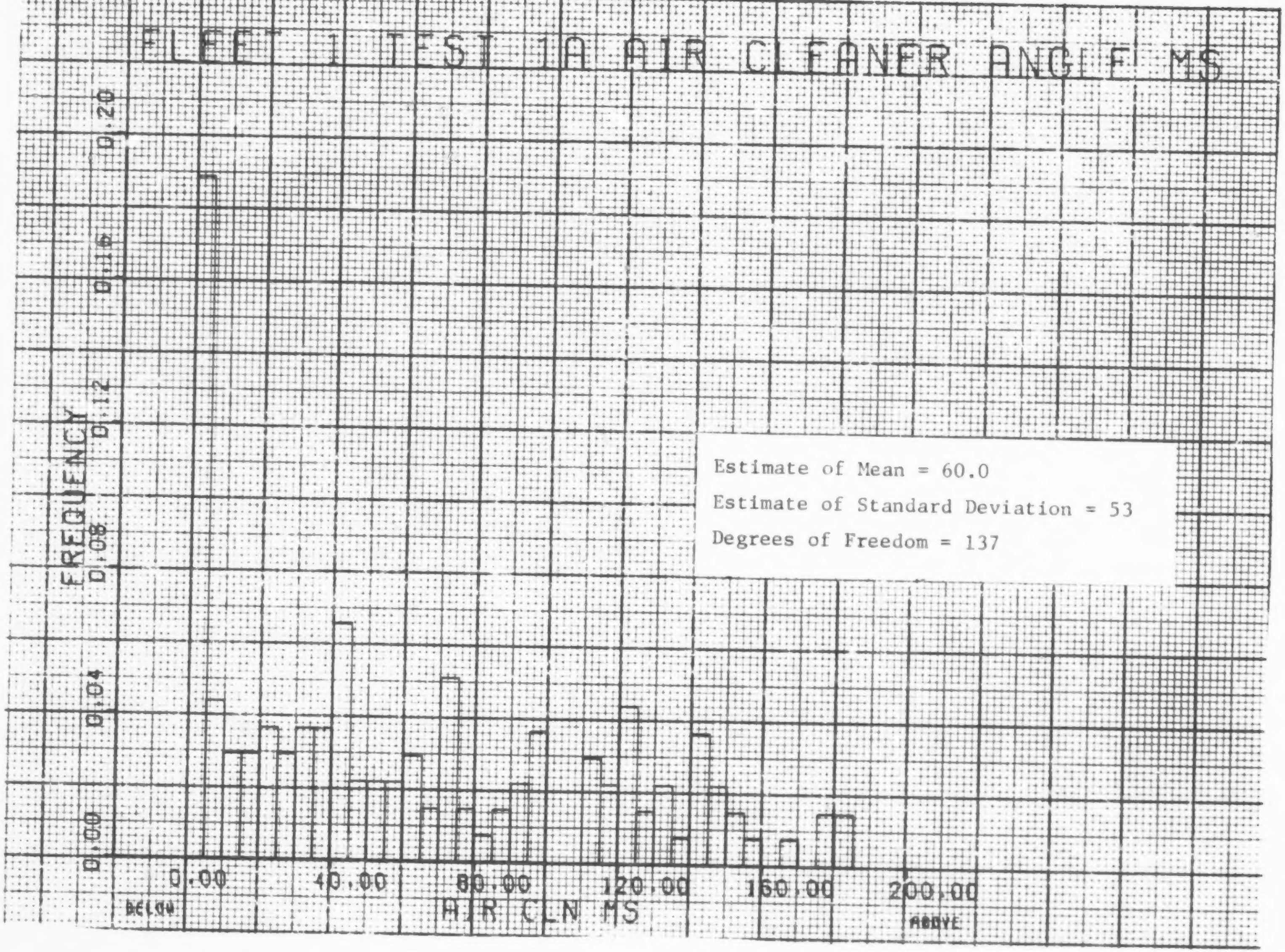


Estimate of Mean = -5.68

Estimate of Standard Deviation = 138

Degrees of Freedom = 149

FIGURE 2.32

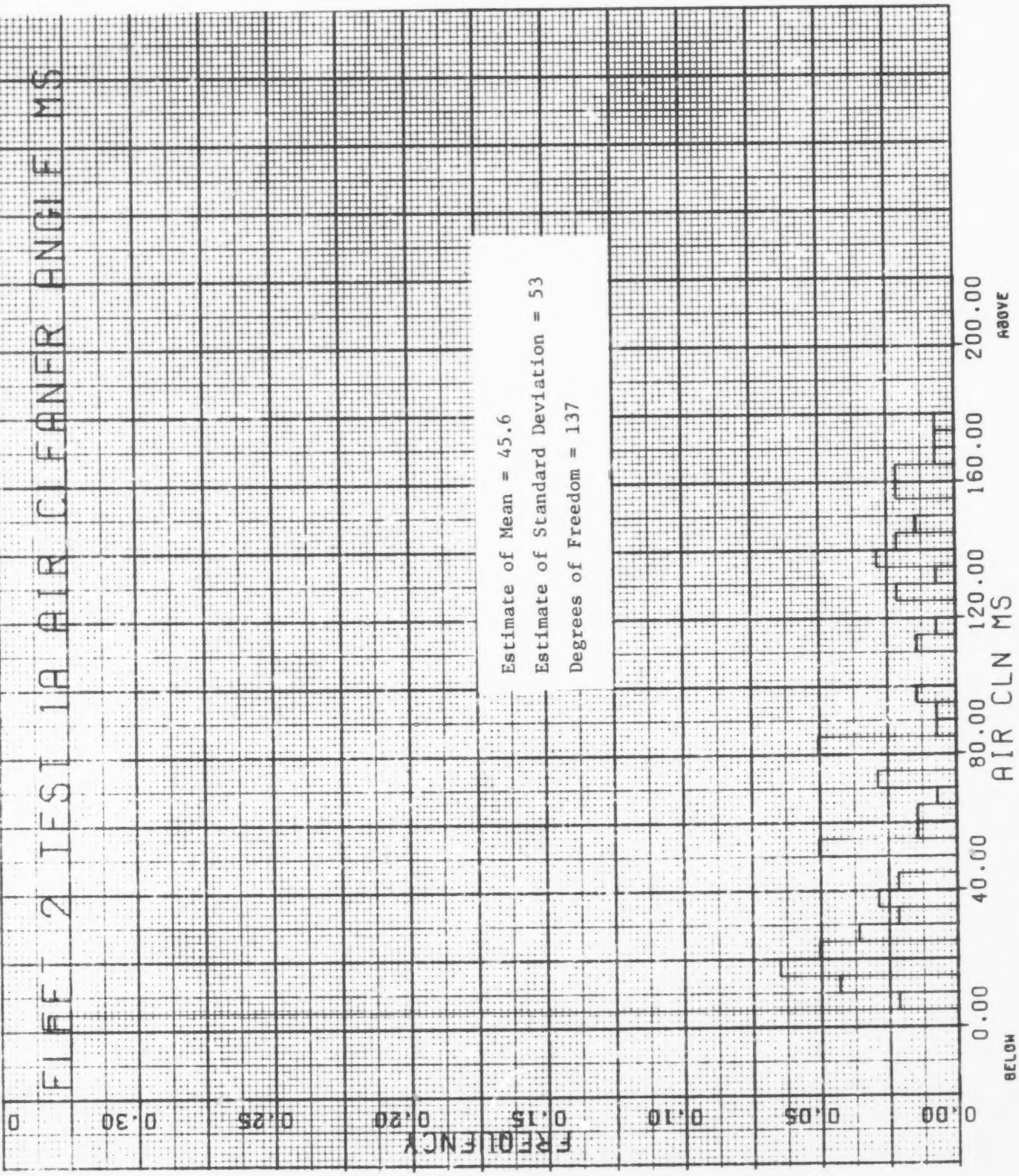


Estimate of Mean = 60.0

Estimate of Standard Deviation = 53

Degrees of Freedom = 137

FIGURE 2.33

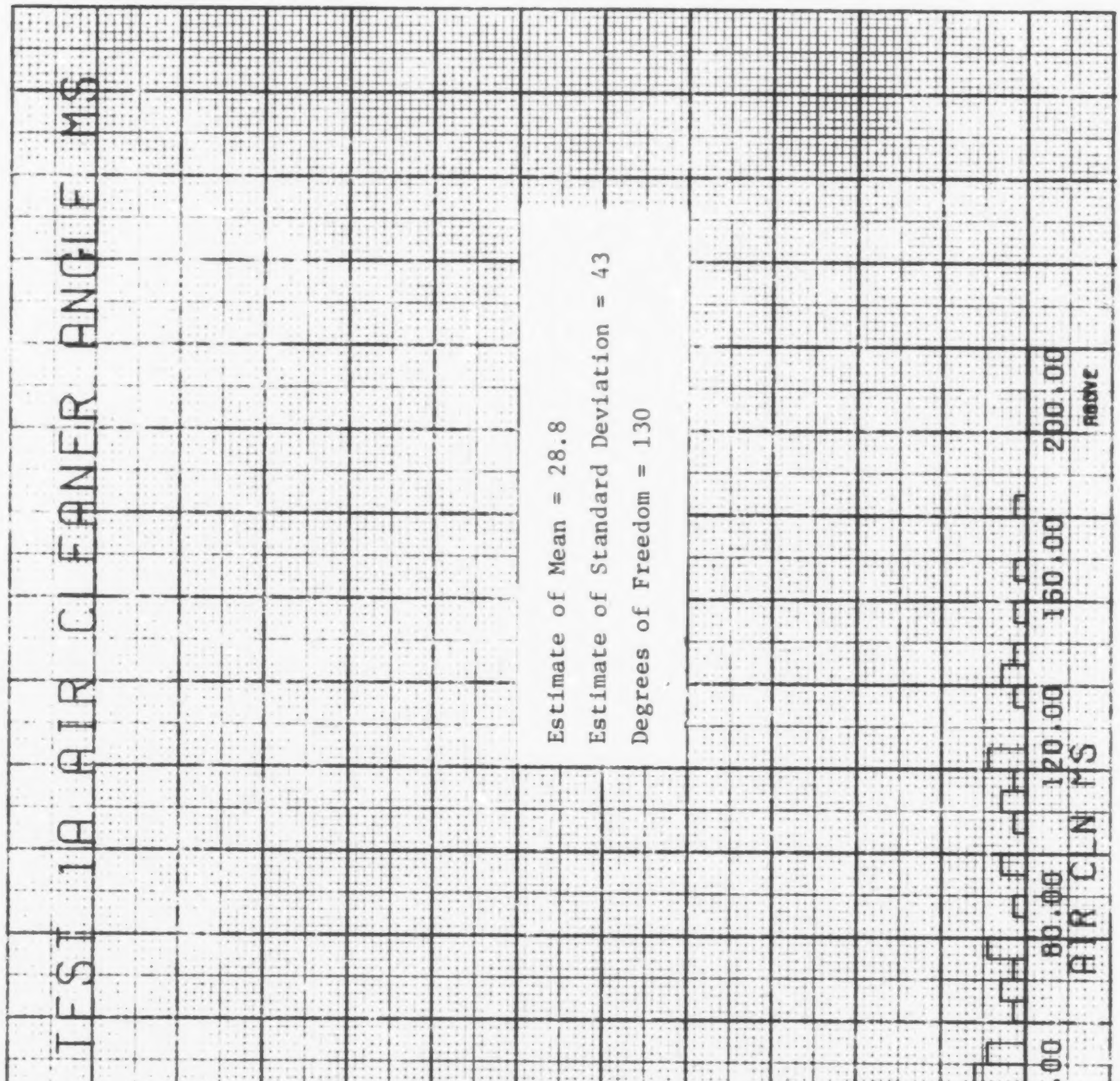


Estimate of Mean = 45.6

Estimate of Standard Deviation = 53

Degrees of Freedom = 137

FIGURE 2.34



Estimate of Mean = 28.8
Estimate of Standard Deviation = 43
Degrees of Freedom = 130

to be skewed with most elements performing nominally. An air cleaner angle in excess of 140 degrees is considered to be unsatisfactory. As expected, the older vehicles tend to have a larger number of excessive air cleaner restrictions. The corresponding statistics presented in Table 2.6, also indicate a larger number of malfunctions. The mean value for the pre-emission controlled fleet is 60 degrees, 31 degrees larger than the NO_x controlled vehicles.

The PCV flow rate (CFM) measured with the vehicle operating in the 49/45 RPM Clayton Cruise is presented in Figures 2.35 through 2.37. In all cases the distributions were comparatively continuous and normally distributed.

The deviation of the choke kick, measured in inches, is given in Figures 2.38 through 2.40. In contrast to the other parameters which show progressively smaller deviations of mean value and estimate of standard deviation for newer vehicle fleets, the distribution of choke kick tended to be the same for all vehicle fleets.

2.6.2 Maintenance Effects on Emissions and Engine Parameters

All of the vehicles selected for the engine parameter deterioration experiment were initially restored to manufacturers' specifications. Each vehicle was emission tested and parameter inspected prior to and following the initialization process. This section reports the resulting changes effected in the parameters and emissions. It should be noted that the vehicle maintenance was generally substantial (e.g., major tune-up) and consistently applied to all of the vehicles. Therefore, these results are not directly compatible to those of the system study described in Volume II.

A detailed presentation of the pre-tune condition (Test 1A) and the post-tune condition (Test 1B) is shown in Appendix A. The estimates of the means, standard deviation, degrees of freedom, and the student "t" values of a representative set of the more significant parameters are presented in Table 2.7.

FIGURE 2.35

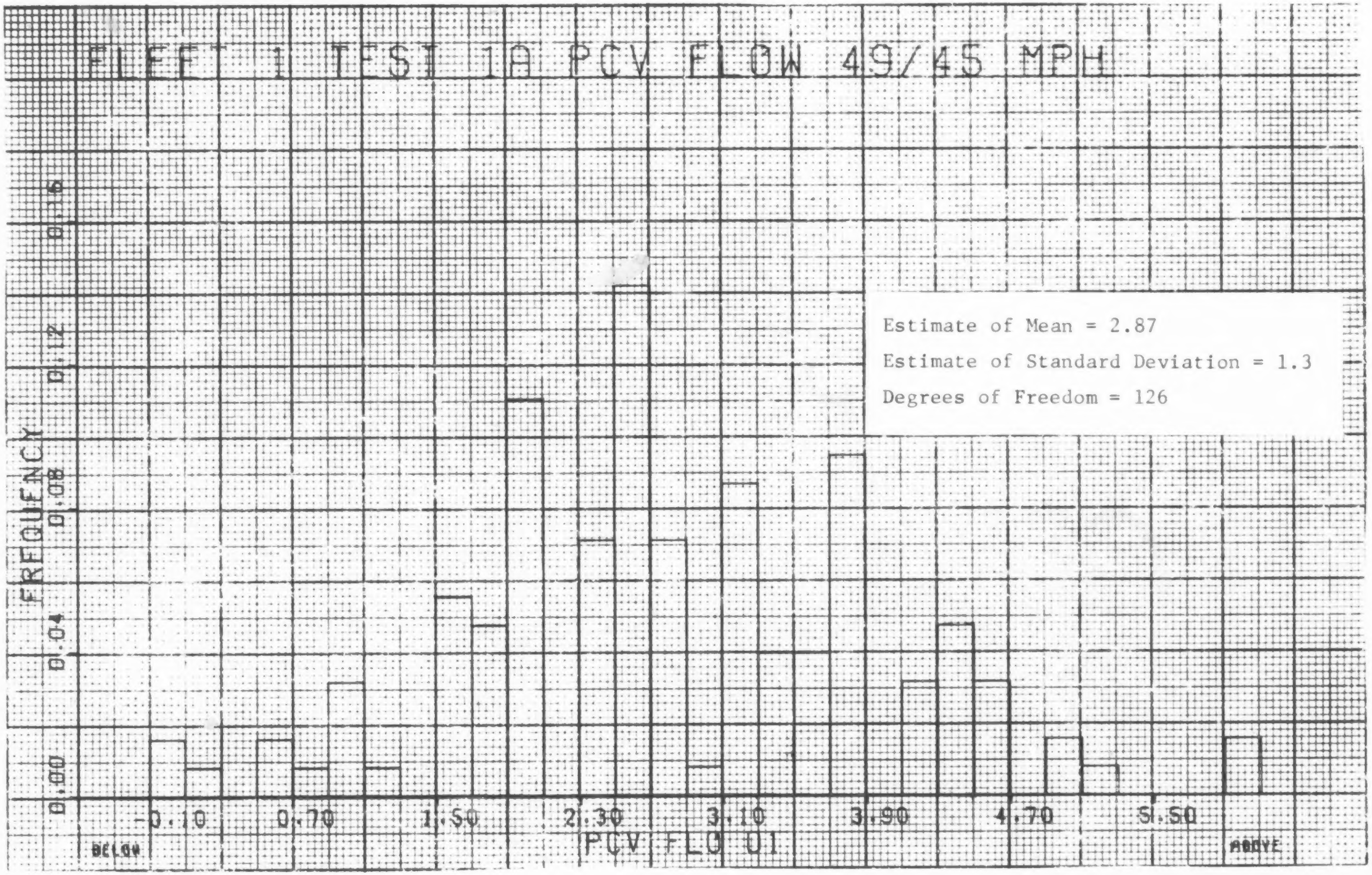
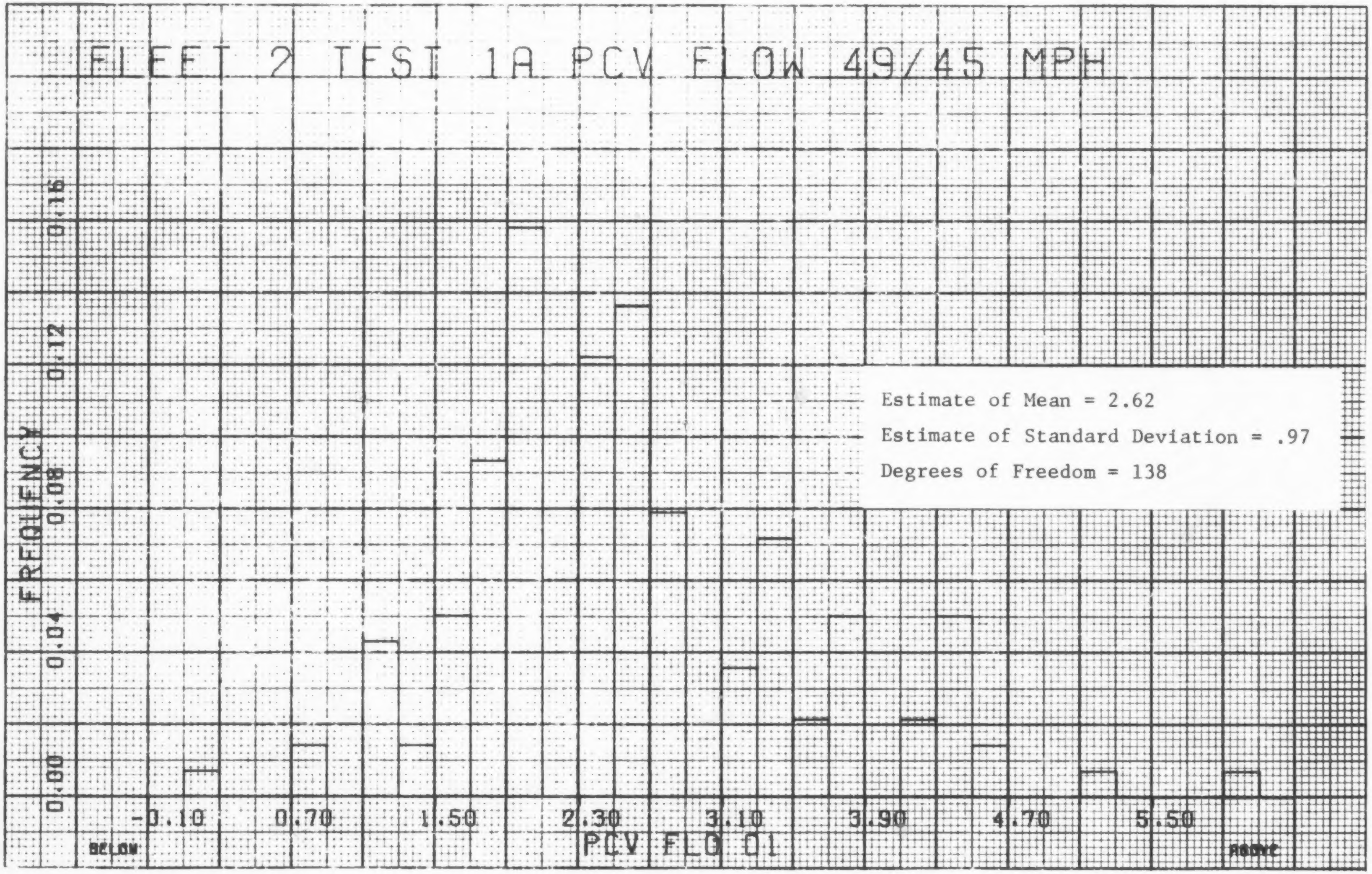

FLEET 1 TEST 1A PCV FLOW 49/45 MPH
Estimate of Mean = 2.87
Estimate of Standard Deviation = 1.3
Degrees of Freedom = 126
FREQUENCY
0.00
0.04
0.08
0.12
0.16
BELOW
-0.10
0.70
1.50
2.30
3.10
3.90
4.70
5.50
ABOVE
PCV FLO 01

FIGURE 2.36

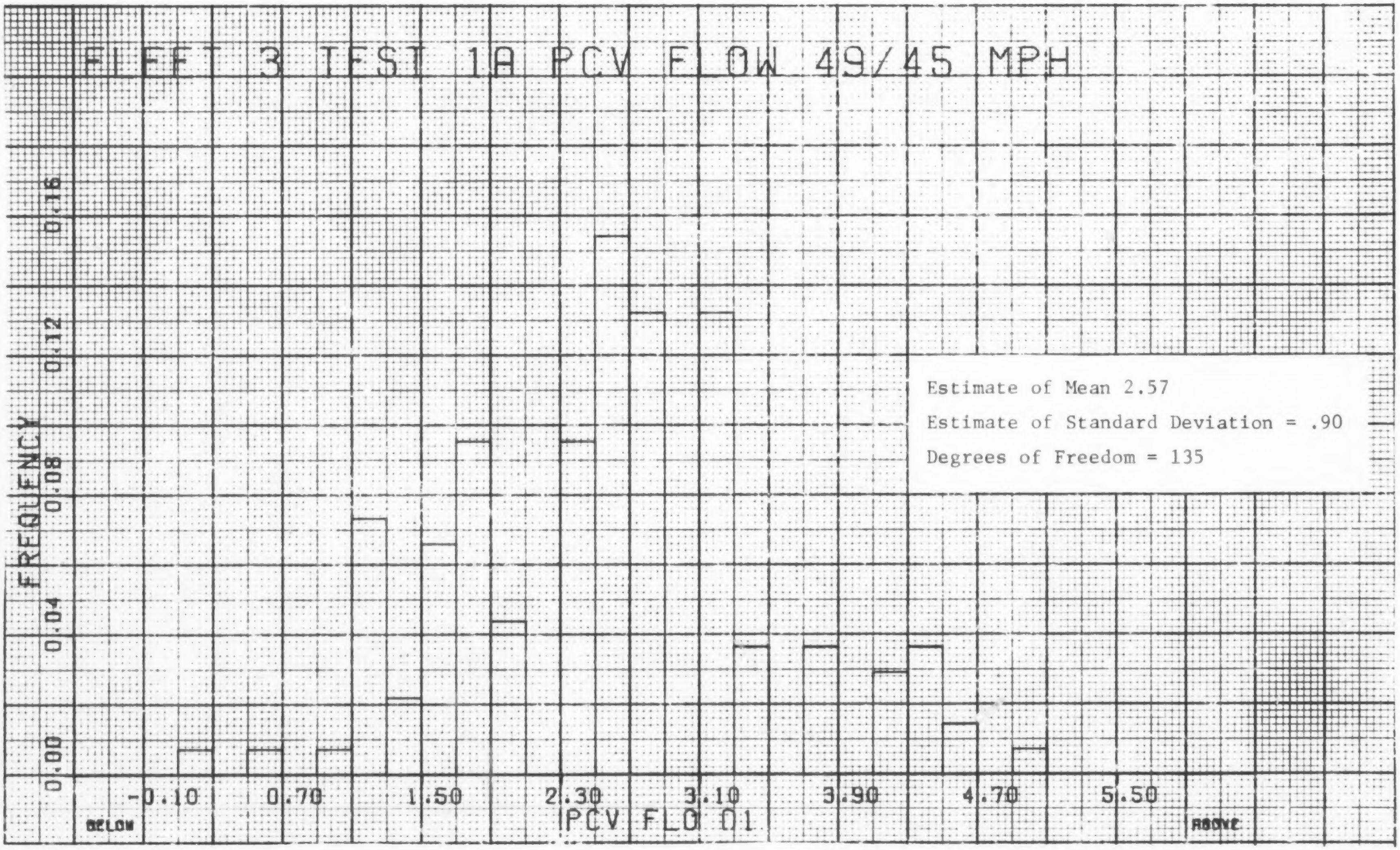


Estimate of Mean = 2.62

Estimate of Standard Deviation = .97

Degrees of Freedom = 138

FIGURE 2.37

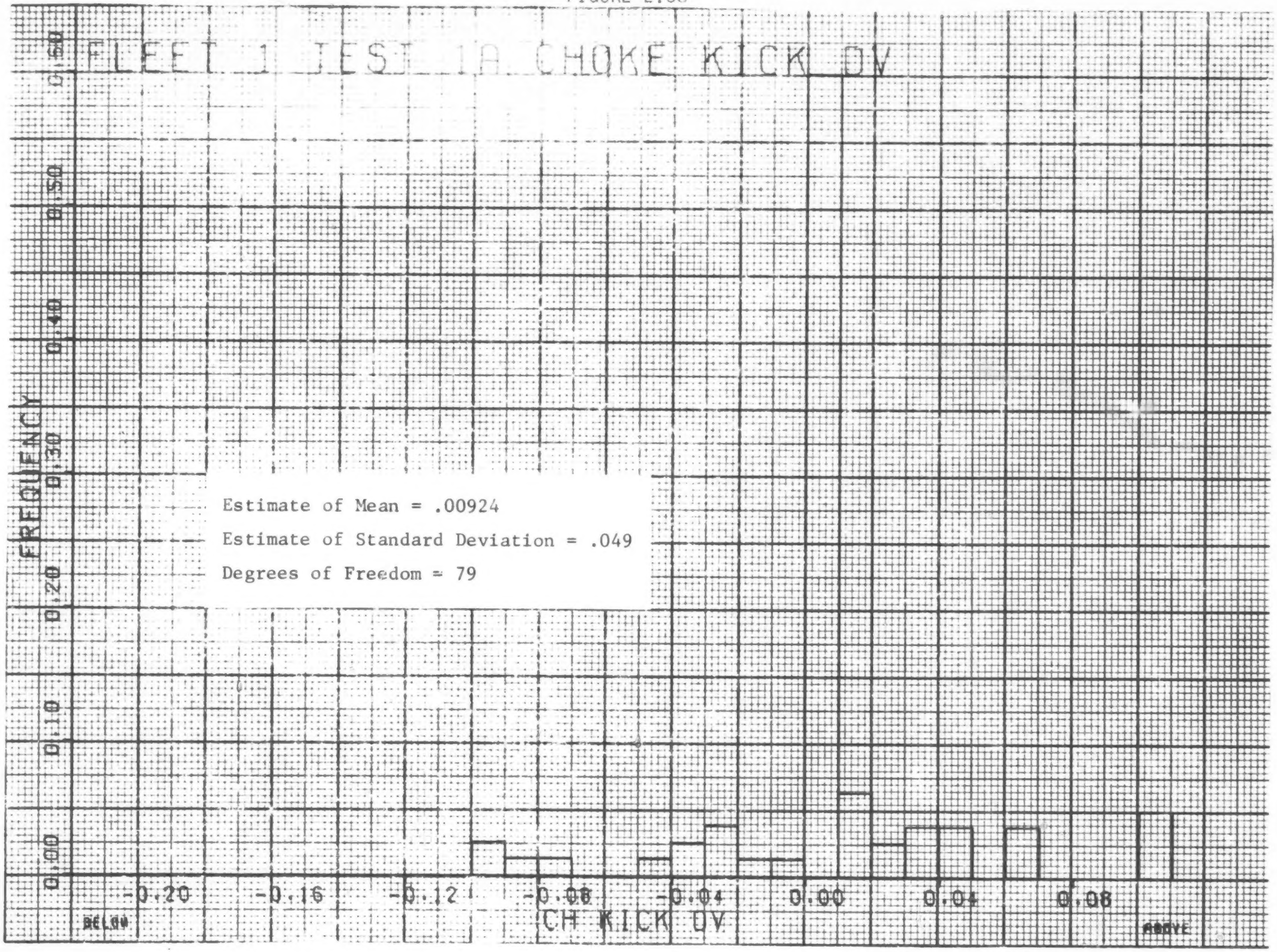


Estimate of Mean 2.57

Estimate of Standard Deviation = .90

Degrees of Freedom = 135

FIGURE 2.38

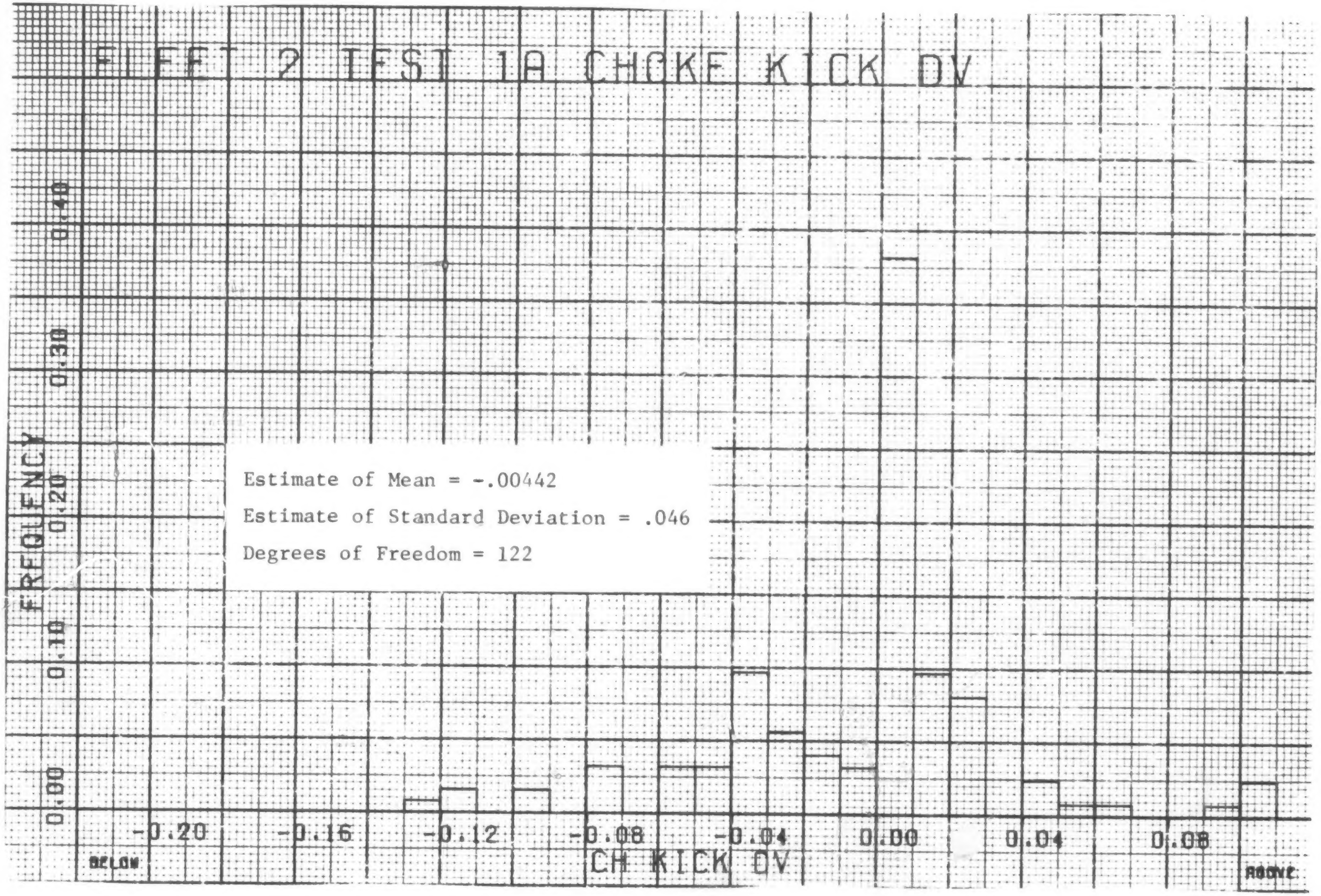


Estimate of Mean = .00924

Estimate of Standard Deviation = .049

Degrees of Freedom = 79

FIGURE 2.39

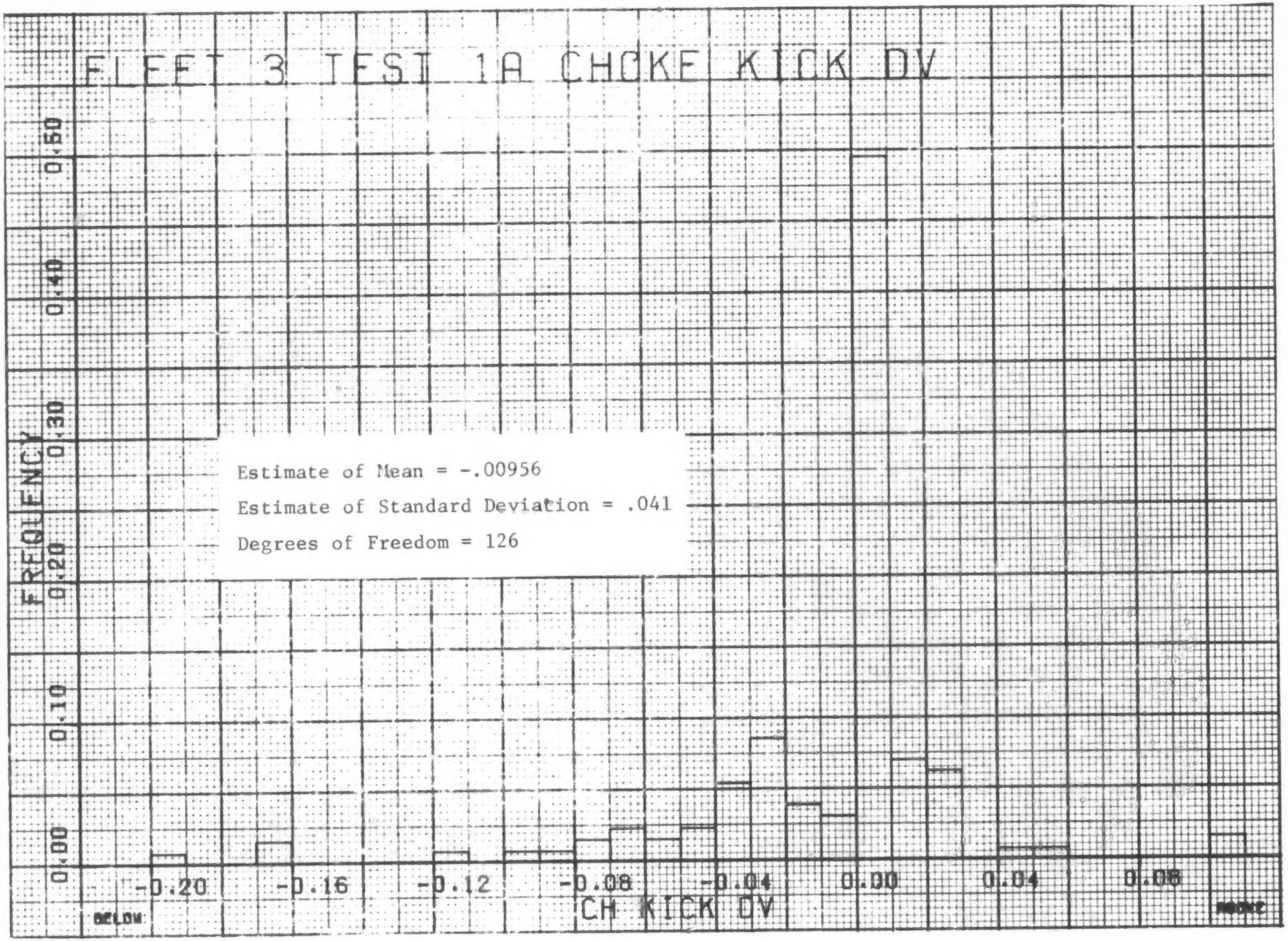


Estimate of Mean = -.00442

Estimate of Standard Deviation = .046

Degrees of Freedom = 122

FIGURE 2.40



Estimate of Mean = -.00956

Estimate of Standard Deviation = .041

Degrees of Freedom = 126

TABLE 2.7
AS RECEIVED VEHICLE PARAMETERS & THEIR CHANGE WITH MAINTENANCE

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES					EMISSION CONTROLLED VEHICLES					NO_X CONTROLLED VEHICLES				
	AS RECEIVED	CHANGE DUE TO TUNE				AS RECEIVED	CHANGE DUE TO TUNE				AS RECEIVED	CHANGE DUE TO TUNE			
	$\bar{X}$	$\overline{\Delta X}$	S	d.f.	t	$\bar{X}$	$\overline{\Delta X}$	S	d.f.	t	$\bar{X}$	$\overline{\Delta X}$	S	d.f.	t
HC 72 COLD, g/mile	12.00	-1.22	5.6	147	-2.64*	7.25	-1.00	5.5	149	-2.23*	4.44	-0.05	1.9	148	-0.32
CO 72 COLD, g/mile	131.5	-9.0	48	147	-2.31*	86.9	-6.30	37	149	-2.10*	63.4	-5.5	29	147	-2.29*
NOX 72 COLD, g/mile	3.97	0.27	1.6	147	2.01*	6.33	0.17	2.2	149	0.94	5.95	-0.14	1.6	148	-1.07
HC D1 (49/45), ppm	383	-123	447	147	-3.35*	222	-38.8	332	147	-1.42	135	-7.90	48	148	-2.01*
CO D1 (49/45), % v	3.45	-0.260	2.0	147	-1.60	1.22	0.048	0.73	149	0.81	0.87	-0.063	0.95	148	-0.81
NOX D1 (49/45), ppm	1666	103.0	633	147	1.98*	2613	20.5	714	149	0.35	2537	13.2	570	147	0.28
HC D3 (IDLE), ppm	865	-117	857	146	-1.66	376	-66.4	516	148	-1.57	240	-40.4	194	148	-2.55*
CO D3 (IDLE), % v	6.08	-0.26	3.2	147	-1.02	4.09	-0.82	2.7	149	-3.68*	3.34	-0.52	2.5	148	-2.51*
NOX D3 (IDLE), ppm	126.8	-23.1	135	147	-2.09*	124.2	18.4	141	149	1.60	168	3.46	84	147	0.50
TIMING, degrees (DV)	0.35	-0.35	5.7	147	-0.75	0.50	-0.46	4.7	146	-1.19	0.17	-0.13	3.3	147	-0.49
IRPM, rpm (DV)	77.9	-61	140	147	-5.31*	-18.2	19	108	148	2.11*	-5.68	13.8	94	149	1.81
AIR CLN ANGLE, degrees	60.0	-28.4	51	133	-6.43*	45.6	-22.4	48	134	-5.37*	28.8	-13.2	34	128	-4.39*
PCV FLO D1, cfm	2.87	0.16	1.5	126	1.21	2.62	-0.0011	0.99	138	-0.01	2.58	0.046	0.84	134	0.64
CHOKE KICK, in.	$9.24\text{x}10^{-3}$	$-9.22\text{x}10^{-3}$	0.050	79	-1.64	$-4.42\text{x}10^{-3}$	$2.98\text{x}10^{-3}$	0.047	122	0.70	$-9.56\text{x}10^{-3}$	$9.81\text{x}10^{-3}$	0.039	127	-2.82*
MILEAGE, miles	83358	-	-	-	-	43786	-	-	-	-	8059	-	-	-	-

*Estimates of means significant (confidence equal to or greater than 90%).

2.6.2.1 Pre-Emission Controlled Vehicles (Fleet 1)

The results obtained with the pre-emission controlled vehicles indicated significant changes in all of the emissions measured using the 1972 Federal CVS Procedure. The changes in CO and HC emissions were respectively 7 and 10 percent. The corresponding emission changes in the Clayton keymodes were similar to those of the Federal Procedure, but were not significant in all cases. The changes that were effected in engine parameters by adjustment and component replacement (re: restoring the manufacturer's specification) suggests that the initialization was performed satisfactorily. Although all of the parameters measured are presented in the Appendix, only those parameters shown in the orthogonal experiment to have a substantial impact on emissions are presented in Table 2.7.

2.6.2.2 Emission Controlled Vehicles (Fleet 2)

The change in the emissions due to maintenance reduced CO and HC emissions as measured by the 1972 Federal Procedure by respectively 7 and 14 percent of the values measured prior to engine tune. Although a positive change in the NO_x emissions resulted, it was not statistically significant. Again, the Clayton keymode data tended to support the changes observed using the Federal Procedure, and cases of statistically significant changes were very few. As was the case with the pre-emission controlled vehicles, the effectiveness of the tune-up is clearly indicated by the changes that were effected in the engine parameters.

2.6.2.3 NO_x Controlled Vehicles (Fleet 3)

The NO_x controlled fleet consisted of 1971 California vehicles. As received, the average mileage of the fleet was approximately 8000 miles. The vehicles were, therefore, in good repair and only a minimum effect on emissions could be expected because of maintenance. The emissions measured using the 1972 Federal Procedure were reduced in all cases, including NO_x. The change in CO was, however, the only emission that was found to be statistically significant. The changes in HC and CO were further confirmed in the emissions measured using the Clayton cycles. In contrast, the sign of the NO_x emissions measured using the Clayton cycle was different than the results observed with the 1972 Federal CVS Procedure, but was not statistically significant. The deviation in specification of the engine parameters showed comparatively small values. Most of the CO mass emissions change can be attributed to the leaner idle fuel to air (CO) setting achieved through maintenance.

HC emission reductions are not substantial because virtually no vehicles in this fleet had ignition system failures. This statement is supported by the small reduction in HC emissions of the high load mode which is a good indicator of ignition system malfunctions.

2.6.2.4 Maintenance Effects on Emission Changes for Vehicles with High Keymode Emissions

A cursory assessment of the data was made to determine if vehicles with high emission as measured in the idle operating mode, have larger achievable reductions upon maintenance than can be obtained by maintaining the entire population. The result, presented in Table 2.8, shows the difference in the average change in emission of the rejected subset and the total data set. Relative to the fraction rejected, reductions of 2 to 3 times those obtained by maintaining all vehicles indiscriminately are possible. A screening process using an emission inspection would appear to be a cost effective strategy. The following section describes a detailed evaluation of the data to select emission-operating modes with high diagnostic content.

2.6.3 Emission Signatures Diagnostic Content

One of the strategies investigated in the economic effectiveness study incorporates a screening inspection in a state lane using emissions measured in vehicle operating modes (emission signatures). This inspection would be following by an engine parameter inspection at the repair agency. The success of this strategy depends upon the effectiveness of the emission signature in identifying specific parameter malfunctions. For example, the malfunction fraction of those vehicles which were rejected following an emission inspection would have to be greater than those which could be found in a random selection of vehicles. A computer exercise was therefore undertaken to characterize the diagnostic content of emission inspection procedures.

TABLE 2.8

EFFECT OF IDLE EMISSION INSPECTION PRIOR TO MAINTENANCE

VEHICLE FLEET	EMISSION	SELECTION CRITERIA	AS RECEIVED g/mile	CHANGE DUE TO TUNE			
				ΔX g/mile	S g/mile	d.f.	t
FLEET 1	HC 1972 FED	NONE	12.00	-1.22	5.6	147	2.64*
PRE-EMISSION CONTROLLED VEHICLES	HC 1972 FED	IDLE HC ≥ 800 ppm	-	-4.46	8.8	41	3.30*
	CO 1972 FED	NONE	131.5	-9.03	48	147	2.31*
	CO 1972 FED	IDLE CO ≥ 8.0 % v	-	-21.4	44	40	3.13*
	NOX 1972 FED	NONE	3.97	0.27	1.6	147	-2.01*
	NOX 1972 FED	IDLE CO ≥ 8.0 % v	-	0.32	1.1	40	-1.91*
FLEET 2	HC 1972 FED	NONE	7.25	-1.00	5.5	149	2.23*
EMISSION CONTROLLED VEHICLES	HC 1972 FED	IDLE HC ≥ 350 ppm	-	-2.97	6.7	38	2.78*
	CO 1972 FED	NONE	86.9	-6.30	37	149	2.10*
	CO 1972 FED	IDLE CO ≥ 5.5 % v	-	-15.5	39	44	2.68*
	NOX 1972 FED	NONE	6.33	0.17	2.2	149	-0.94
	NOX 1972 FED	IDLE CO ≥ 5.5 % v	-	0.35	2.5	44	-0.94
FLEET 3	HC 1972 FED	NONE	4.44	-0.05	1.9	148	0.32
NOX CONTROLLED VEHICLES	HC 1972 FED	IDLE HC ≥ 250 ppm	-	-0.30	2.2	47	0.93
	CO 1972 FED	NONE	63.4	-5.51	29	147	2.29*
	CO 1972 FED	IDLE CO ≥ 4.5 % v	-	-9.81	28	43	2.35*
	NOX 1972 FED	NONE	5.94	-0.14	1.6	148	1.1
	NOX 1972 FED	IDLE CO ≥ 4.5 % v	-	0.19	1.4	43	0.93

*Data significant at the 90 percent confidence level.

2.6.3.1 Preliminary Emission Mode Selections

Pre and post tune-up emission measurements during the three Clayton keymodes were performed for all vehicles in the parameter deterioration experiment. These tests: 1) 49/45 RPM Cruise Mode, 2) 33/30 MPH Cruise Mode, and 3) Idle, were conducted with a hot engine immediately after the 1972 Federal CVS Procedure, 7-Mode CVS Procedure and Federal Short Cycle tests were performed.

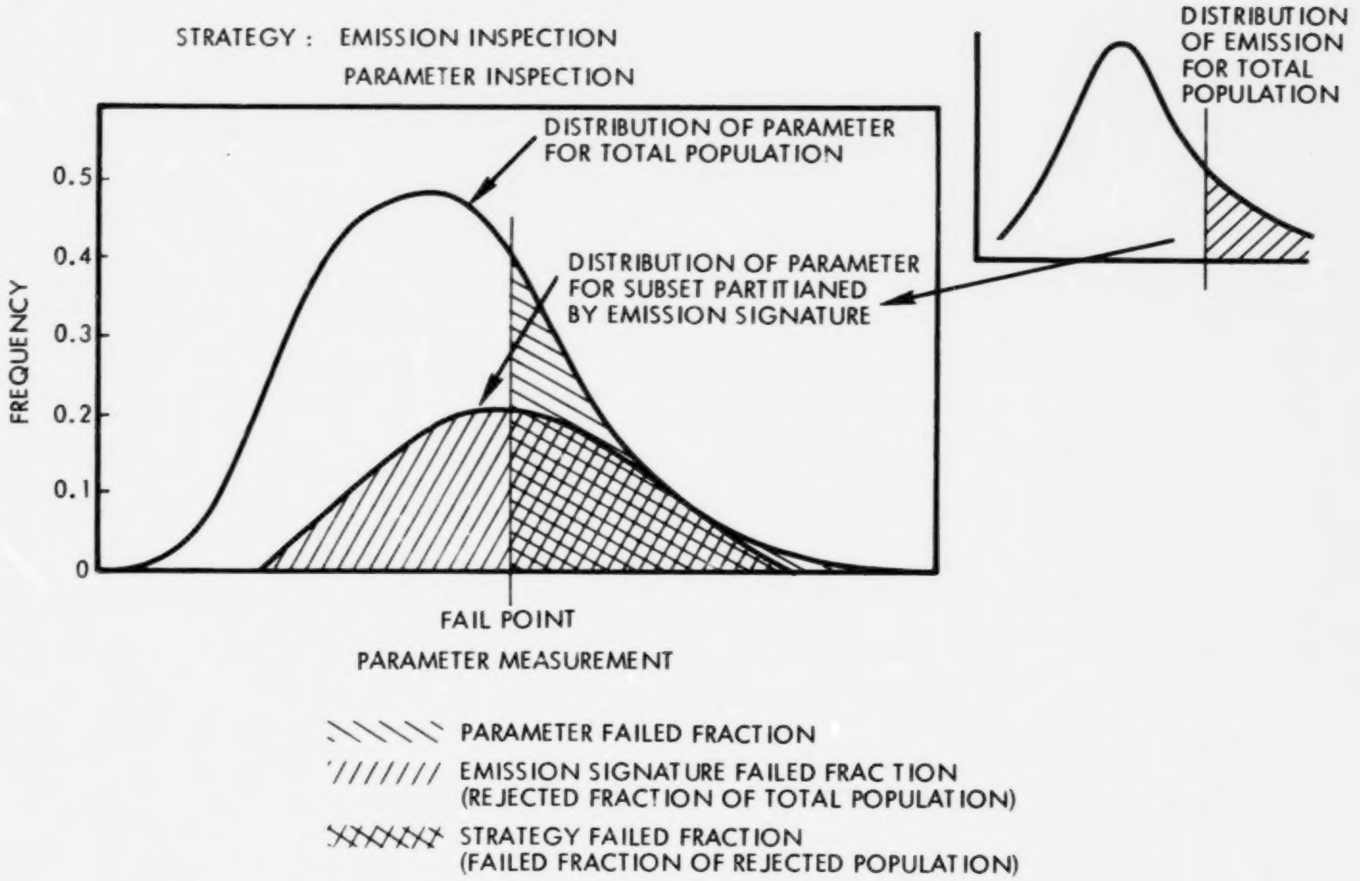
There are a significant number of emission signatures taken singularly and in combination which have potential diagnostic content. Review of existing data from previous years study (Reference 9) indicated that many of the emission signatures would not be effective in identifying parameter malfunctions. In addition, it was concluded that the mid-range cruise mode, i.e., 33/30 MPH Cruise, generally did not identify malfunctions that would not have been detected in either the high cruise mode, i.e., 49/45 MPH Cruise or the Idle mode. It was also concluded that it was not usually effective to apply a combination of more than two emission signatures simultaneously to identify a specific malfunction. A cursory set of computer runs were therefore developed with those combinations of signatures that were considered to have good specificity and good diagnostic content. On the basis of this analysis, the signatures which indicated the greatest potential for being effective were selected for further characterization.

2.6.3.2 Method of Analysis

The effectiveness of an emission measurement in identifying a parameter can be empirically developed by analyzing the engine parameters partitioned by the emission inspection. The general approach for developing the effectiveness of a given emission parameter is illustrated in Figure 2.41. Any given emission signature, i.e., Idle HC, Idle CO, etc., will have a finite distribution (distribution of emissions for the total population). In addition, there will be a corresponding distribution for the associated engine parameter (distribution of parameter for total population). A subset of the total population is defined by selecting the vehicles which have emissions higher than a given limit value. This subset is defined by the shaded area shown in the distribution of the emission signature. The corresponding distribution of the engine (malfunction)

FIGURE 2.41

DATA ANALYSIS SUPPORT OF ECONOMIC EFFECTIVENESS MODEL



parameter for those vehicles which were identified by the emission inspection is shown superimposed on that of the total population. This distribution is shaded with lines of positive slope (emission signature failed fraction). Those engine parameters within this distribution considered to be failed are that fraction which are cost effective to repair (i.e., which fail an additional direct inspection at the repair agency). This subset is identified with the shaded area of negative slope. The intersection of the two populations constitutes the fraction of the population (cross-hatched) which were: 1) identified as potentially having malfunctioned parameters and 2) are verified to actually be malfunctioned. The degree of effectiveness of an emission signature inspection will therefore be directly proportional to the failed fraction of the rejected subset relative to the failed fraction within the total population. The computer exercise in developing the effectiveness of emission signatures consisted of applying this sorting criteria to the experimental data.

In order to exercise the economic effectiveness program utilizing the emission signatures strategy it is necessary to quantitatively characterize the effectiveness of the emission signatures. This requires the development of the rejected and failed fractions and the extent of malfunction of the failed fraction of engine parameters identified with various emission signature cutpoints. The characterization of the emission signatures was made with the data from the three vehicle fleets tested in San Bernardino, i.e., pre-emission controlled vehicles (Fleet 1, 1960-1965), emission controlled vehicles (Fleet 2, 1966-1970), and NO_x controlled vehicles, (Fleet 3, 1971), and the two vehicle fleets tested in Detroit, i.e., pre-emission controlled vehicles (Fleet 1, 1960-1967), and emission controlled vehicles (Fleet 2, 1968-1971). The parameters which were characterized were idle RPM, timing, PCV exhaust flowrate, air cleaner restriction, and air pump failure. The two other parameters which are considered important to emission control, i.e., Idle mixture and Misfire, were not evaluated. Idle fuel-to-air ratio (e.g., CO) was not characterized because the value of CO in the Idle Clayton mode was considered the prime measurement. Misfire was not included in the characterization because, as described in Section 2.6.5, a reliable quantitative measure of misfire was not available. In fact, the misfire rate as presented in this report, was developed from the examination of the keymode emissions. Therefore, a direct correlation between HC emission signatures and this parameter is implied in the data analysis procedure.

2.6.3.3 Effectiveness of Emission Signatures

The effectiveness of emission signatures was analyzed using the histogram program (HISTO) which partitions the data according to specified criteria and provides graphical plots. An example of the type of output that was developed is presented in Figures 2.42, 2.43 and 2.44. These figures typify the results of an investigation to determine the effectiveness of a HC measurement in the 49/45 MPH Cruise Mode in identifying timing malfunctions. Malfunction in timing was defined as an advancement greater than 1.5 degrees from the specification value. In each case the primary histogram reports the distribution of timing for the total data set. The distribution as indicated by the shaded lines with a positive slope show the extent and frequency of timing of the vehicle fraction with excessive HC emissions in the High Speed Cruise Mode. The distributions as defined by the shaded lines with a negative slope indicated the fraction which failed both emission and parameter inspections. The figures represent cutpoints of low, medium and high fractions, respectively. Similar data were used to develop the results tabulated in Table 2.9 to 2.26. The variation of the failed fraction of the rejected subset with the rejection fraction, i.e., the fraction rejected by use of emission signature inspection, is presented in Figures 2.45 through 2.49 for the fleets tested in San Bernardino and in Detroit. The tables present the rejected and failed fractions and detected fraction which is defined to be the failed fraction given in terms of the total data set. The estimates of the mean ($\overline{X}$), standard deviation (S), and the corresponding degrees of freedom (d.f.) of the detected data set are presented to indicate the extent of malfunction.

The variation of the failed fraction with the rejected fraction, with timing as the malfunction parameter is presented in Figure 2.45. Preliminary studies suggested that both the Idle HC and High Cruise HC emissions were potentially effective emission signatures. A full characterization of both of these signatures was therefore made. The results which are depicted in Figure 2.45 do not clearly identify the more effective emission signature. The rejected fraction at the High Cruise was less than with the idle HC, but in most cases the failed fraction was greater. The assessment of the more effective emission signature must therefore be made based on the

FIGURE 2.42

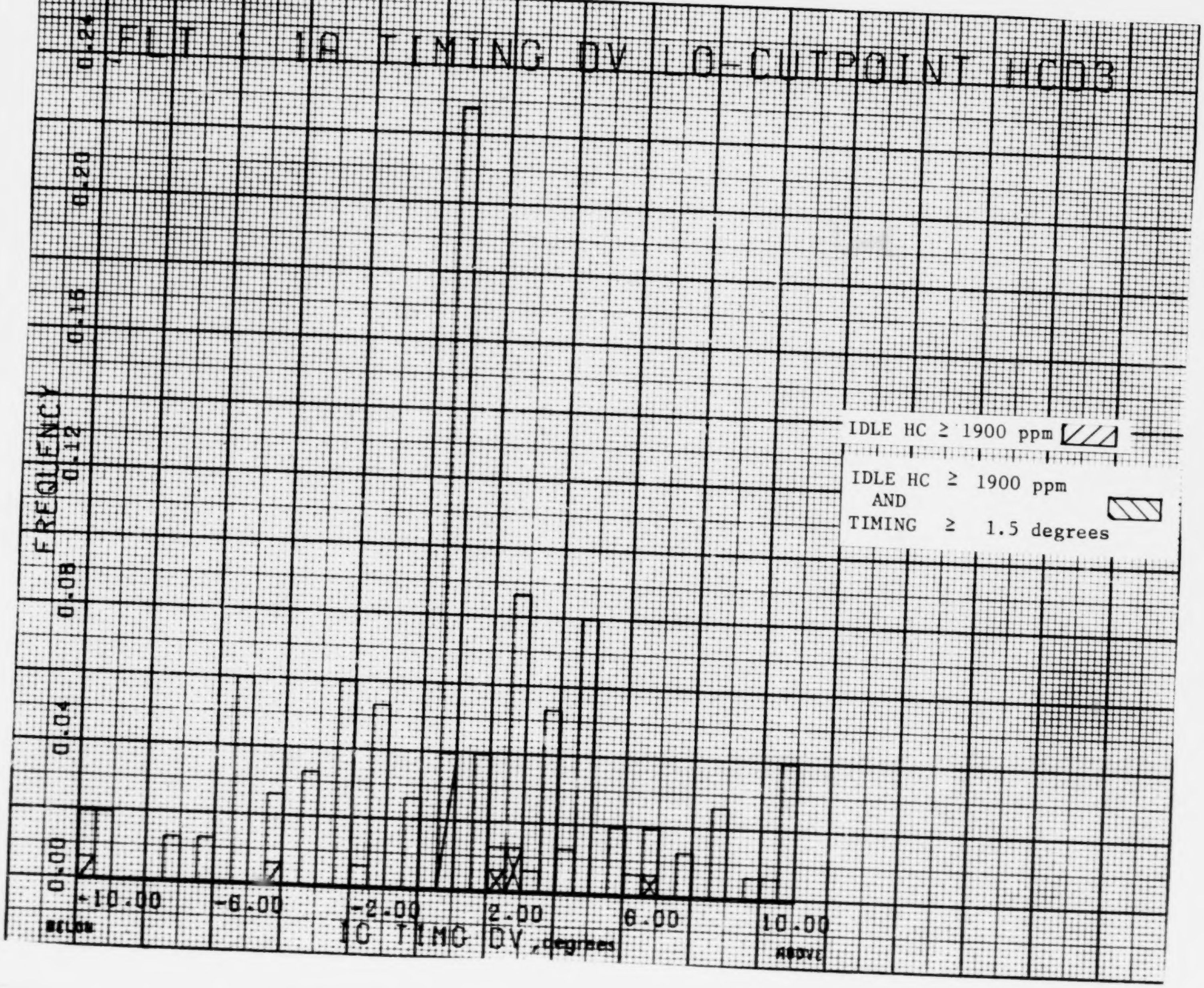

FLT 1 1A TIMING DV LO-CUTPOINT HCD3
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
IDLE HC ≥ 1900 ppm ▨
IDLE HC ≥ 1900 ppm AND TIMING ≥ 1.5 degrees ▧
BELOW
-10.00
-6.00
-2.00
2.00
6.00
10.00
ABOVE
IC TIMG DV ,degrees

FIGURE 2.43

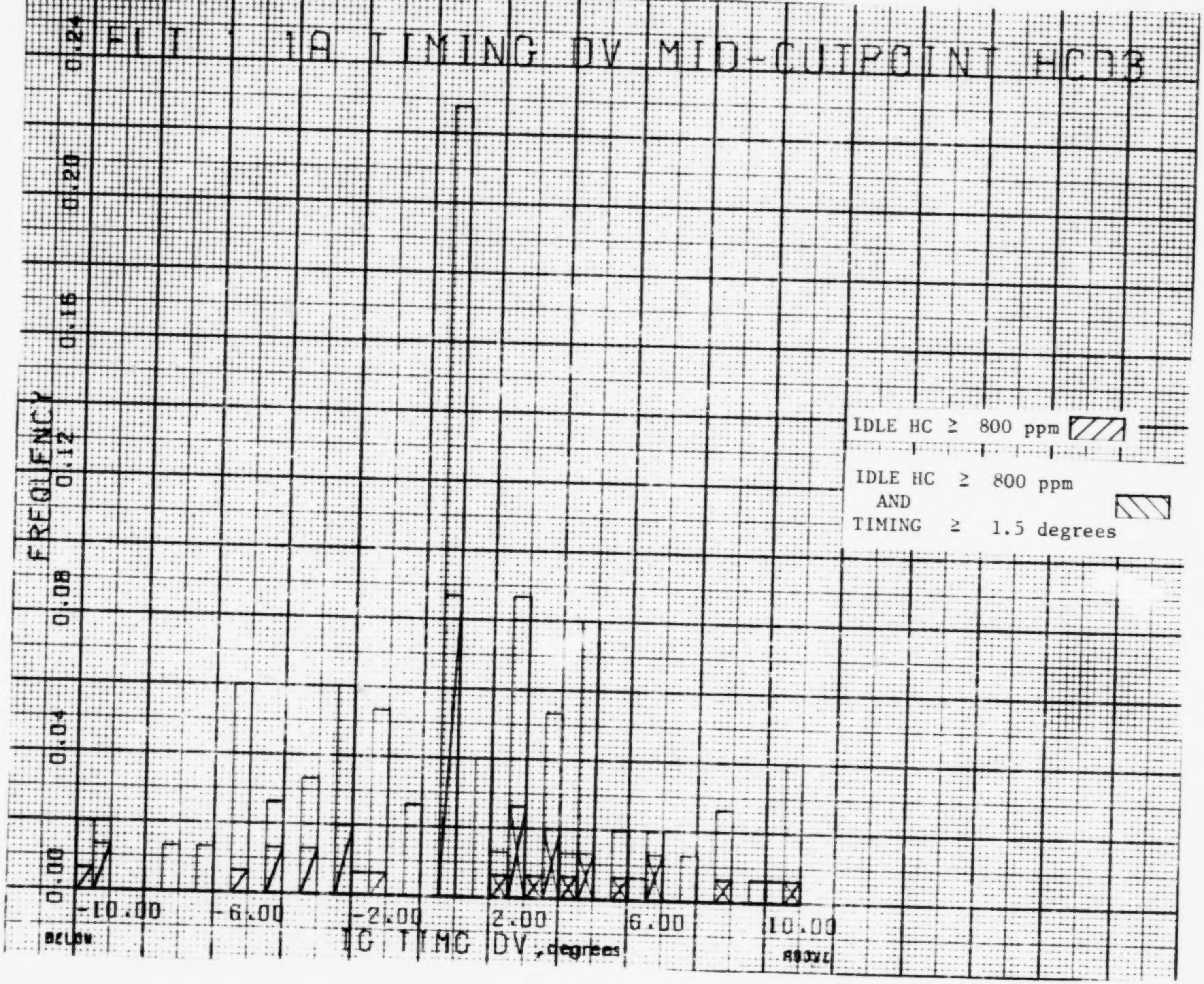

FLT 1A TIMING DV MID-CUTPOINT HCD3
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
BELOW
-10.00
-6.00
-2.00
2.00
6.00
10.00
ABOVE
IG TIMG DV, degrees
IDLE HC ≥ 800 ppm ▨
IDLE HC ≥ 800 ppm AND TIMING ≥ 1.5 degrees ▧

FIGURE 2.44

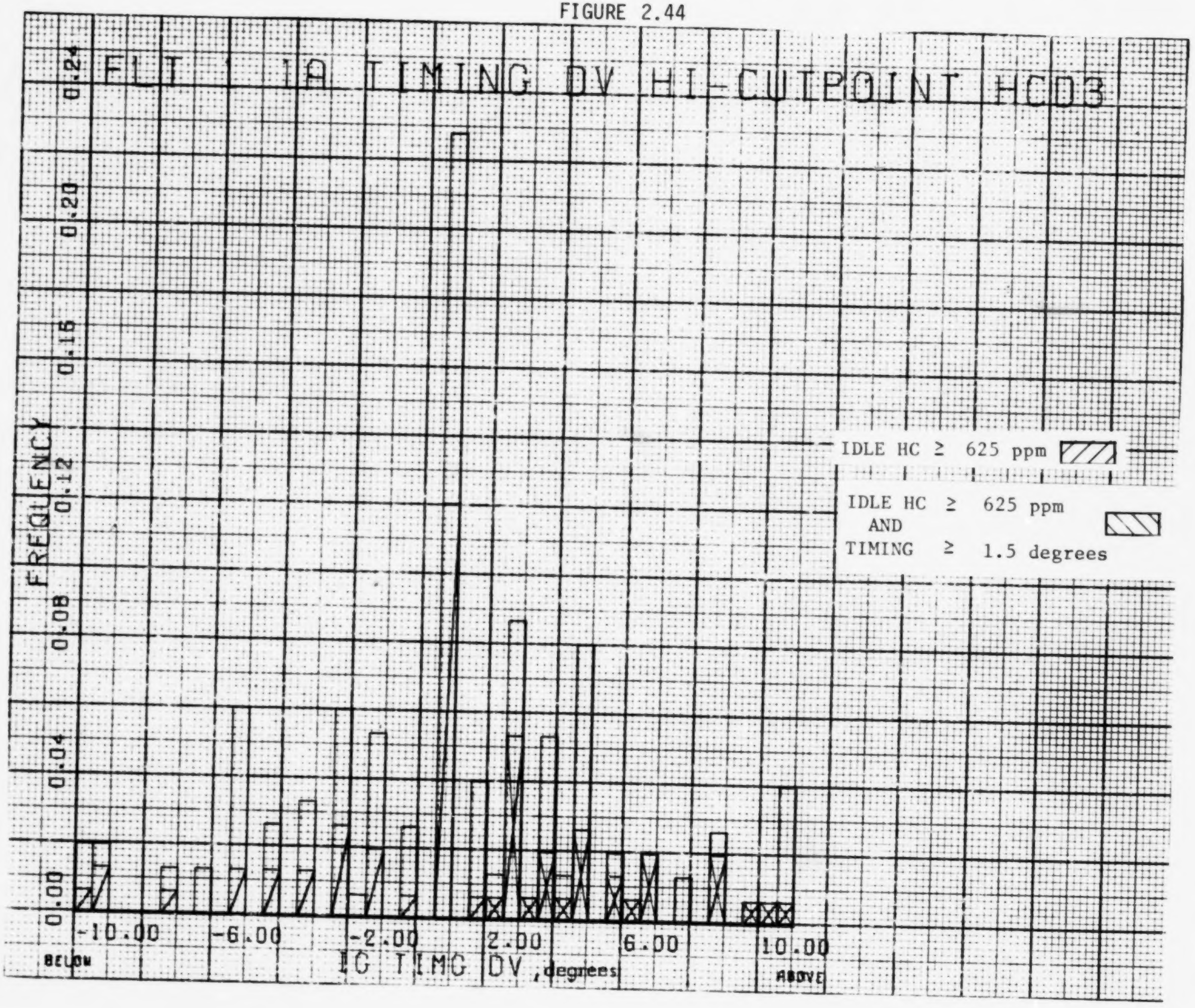

FLT 1 1A TIMING DV HI-CUTPOINT HCD3
FREQUENCY
0.24
0.20
0.16
0.12
0.08
0.04
0.00
BELOW
-10.00
-6.00
-2.00
2.00
6.00
10.00
ABOVE
IC TIMG DV , degrees
IDLE HC ≥ 625 ppm ▨
IDLE HC ≥ 625 ppm
AND
TIMING ≥ 1.5 degrees ▨

TABLE 2.9

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	149	≤ - 80 rpm			10	6.7				
IDLE HC		≥ 1900 ppm	12	8.0	2	16.7	1.3	-150.0	35	1
TIMING, dev. from Spec.	149	≥ 1.5°			59	39.6				
IDLE HC		≥ 1900 ppm	12	8.0	4	33.3	2.7	2.88	2.1	3
49/45 MPH HC		≥ 875 ppm	8	5.4	4	50.0	2.7	3.00	2.0	3
PCV FLOW, measured	127	≤ 1.5 cfm			11	8.7				
IDLE CO		≥ 9.0 % v	23	18.1	3	13.0	2.4	0.950	0.40	2
49/45 MPH HC or CO		≥ 875 ppm, ≥ 9.5 % v	0	0.0	0	0.0	0.0			
AIR CLEANER, measured	138	≥ 100°			33	23.9				
49/45 MPH HC		≥ 875 ppm	7	5.1	2	28.6	1.4	142.5	46	1
49/45 MPH HC or CO		≥ 875 ppm, ≥ 9.5 % v	11	8.0	2	18.2	1.4	142.5	46	1

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.10

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	149	≤ - 80 rpm			10	6.7				
IDLE HC		≥ 800 ppm	41	27.5	4	9.8	2.7	-122.5	38	3
TIMING, dev. from Spec.	149	≥ 1.5°			59					
IDLE HC		≥ 800 ppm	42	28.2	17	40.5	11.4	4.20	3.1	16
49/45 MPH HC		≥ 450 ppm	19	12.8	8	42.1	5.4	3.62	2.3	7
PCV FLOW, measured	127	≤ 1.5 cfm			11	8.7				
IDLE CO		≥ 8.0 % v	35	27.5	6	7.1	4.7	0.691	0.45	5
49/45 MPH HC or CO		{≥ 450 ppm, {≥ 5.5 % v	31	24.4	3	9.7	2.4	0.432	0.54	2
AIR CLEANER, measured	138	≥ 100°	33			23.9				
49/45 MPH HC		≥ 450 ppm	19	13.8	6	31.6	4.3	136.3	32	5
49/45 MPH HC or CO		{≥ 450 ppm, {≥ 5.5 % v	34	24.6	11	32.4	8.0	141.9	28	10

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.11

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	149	≤ - 80 rpm			10	6.7				
IDLE HC		≥ 625 ppm	66	44.3	4	6.1	2.7	-122	38	3
TIMING, dev. from Spec.	149	≥ 1.5°	59			39.6				
IDLE HC		≥ 625 ppm	67	45.0	30	44.8	20.1	4.62	2.9	29
49/45 MPH HC		≥ 375 ppm	35	23.5	13	37.1	8.7	4.96	3.8	12
PCV FLOW, measured	127	≤ 1.5 cfm			11	8.7				
IDLE CO		≥ 7.0 % v	53	41.7	6	11.3	4.7	0.691	0.45	5
49/45 MPH HC or CO		{≥ 375 ppm, ≥ 4.0 % v	56	44.1	6	10.7	4.7	0.561	0.41	5
AIR CLEANER, measured	138	≥ 100°	33			23.9				
49/45 MPH HC		≥ 375 ppm	32	23.2	10	31.2	7.2	136.7	28	9
49/45 MPH HC or CO		{≥ 375 ppm, ≥ 4.0 % v	61	44.2	20	32.8	14.5	135.5	24	19

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.12

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS
SAN BERNARDINO VEHICLE FLEET
EMISSION CONTROLLED VEHICLES

LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm			35	22.0				
IDLE HC		≥ 400 ppm	30	20.0	10	33.3	6.7	-148	46	9
TIMING, dev. from Spec.	150	≥ 1.5°			55	36.7				
IDLE HC		≥ 400 ppm	30	20.0	12	40.0	8.0	5.79	3.4	11
49/45 MPH HC		≥ 350 ppm	7	4.7	3	42.8	2.0	7.33	3.2	2
PCV FLOW, measured	139	≤ 1.5 cfm			12	8.6				
IDLE CO		≥ 6.5 % v	26	18.7	2	7.7	1.4	0.829	0.80	1
49/45 MPH HC or CO		≥ 350 ppm, ≥ 4.0 % v	8	5.8	0	0.0	0			
AIR CLEANER, measured	138	≥ 100°			25	18.1				
49/45 MPH HC		≥ 350 ppm	6	4.3	1	16.7	0.7	160		
49/45 MPH HC or CO		≥ 350 ppm, ≥ 4.0 % v	7	5.1	1	14.3	0.7	160		

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.13

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET
EMISSION CONTROLLED VEHICLES
MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm				22.0				
IDLE HC		≥ 350 ppm	39	26.0	14	36.0	9.3	-155	49	13
TIMING, dev. from Spec.	150	≥ 1.5°				36.7				
IDLE HC		≥ 350 ppm	39	26.0	15	38.5	10.0	5.7	3.2	14
49/45 MPH HC		≥ 250 ppm	20	13.3	8	40.0	5.3	4.62	2.9	7
PCV FLOW, measured	139	≤ 1.5 cfm				8.6				
IDLE CO		≥ 5.5 % v	42	30.2	3	7.1	2.2	0.984	0.63	2
49/45 MPH HC or CO		≥ 250 ppm, ≥ 2.00 % v	30	21.6	3	10.0	2.2	1.122	0.30	2
AIR CLEANER, measured	138	≥ 100°				18.1				
49/45 MPH HC		≥ 250 ppm	15	10.9	3	20.0	2.2	135	25	2
49/45 MPH HC or CO		≥ 250 ppm, ≥ 2.0 % v	29	21.0	7	24.1	5.1	143	23	6

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.14
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS
SAN BERNARDINO VEHICLE FLEET
EMISSION CONTROLLED VEHICLES
HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm				22.0				
IDLE HC		≥ 300 ppm	54	36.0	17	31.5	11.3	-157	46	16
TIMING, dev. from Spec.	150	≥ 1.5°				36.7				
IDLE HC		≥ 300 ppm	54	36.0	20	37.0	13.3	6.3	3.5	19
49/45 MPH HC		≥ 225 ppm	36	24.0	17	47.2	11.3	4.9	3.2	16
PCV FLOW, measured	139	≤ 1.5 cfm				8.6		2.61	0.97	
IDLE CO		≥ 5.0 % v	57	41.0	4	7.0	2.9	1.06	.54	3
49/45 MPH HC or CO		≥ 225 ppm, ≥ 1.5 % v	56	40.2	6	10.7	4.3	1.148	.29	5
AIR CLEANER, measured	138	≥ 100°				18.1				
49/45 MPH HC		≥ 225 ppm	30	21.8	6	20.0	4.3	140	25	5
49/45 MPH HC or CO		≥ 225 ppm, ≥ 1.5 % v	55	39.9	11	20.0	8.0	140	21	10

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.15

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

NOX CONTROLLED VEHICLES
LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm	-	-	26	17.3				
IDLE HC		≥ 275 ppm	39	26.0	13	33.3	8.7	-153.8	64	12
TIMING, dev. from Spec.	148	≥ 1.5°			42	28.4				
IDLE HC		≥ 275 ppm	39	26.4	13	33.3	8.8	4.77	2.8	12
49/45 MPH HC		≥ 250 ppm	5	3.4	3	60.0	2.0	2.67	1.2	2
PCV FLOW, measured	137	≤ 1.5 cfm			16	11.7				
IDLE CO		≥ 6.0 % v	26	19.0	4	15.4	2.9	1.243	0.14	3
49/45 MPH HC or CO		≥ 250 ppm, ≥ 2.5 % v	7	5.1	1	14.4	0.7	1.35	-	-
AIR CLEANER, measured	131	≥ 100°			14	10.7				
49/45 MPH HC		≥ 250 ppm	3	2.3	1	33.3	0.8	165	-	-
49/45 MPH HC or CO		≥ 250 ppm, ≥ 2.5 % v	7	5.4	2	28.6	1.5	150	21	-

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.16

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

NOX CONTROLLED VEHICLES

MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm			26	17.3				
IDLE HC		≥ 250 ppm	49	32.7	15	30.6	10.0	-150.3	60	14
TIMING, dev. from Spec.	148				42	28.4				
IDLE HC		≥ 250 ppm	49	33.1	14	28.6	9.4	4.71	2.7	13
49/45 MPH HC		≥ 200 ppm	18	12.2	5	27.8	3.4	4.00	2.4	4
PCV FLOW, measured	137	≤ 1.5 cfm			16	11.7				
IDLE CO		≥ 4.5 % v	38	27.7	6	15.8	4.4	1.278	0.12	5
49/45 MPH HC or CO		≥ 200 ppm, ≥ 1.5 % v	22	16.0	2	9.1	1.4	1.321	0.037	1
AIR CLEANER, measured	131	≥ 100°			14	10.7				
49/45 MPH HC		≥ 200 ppm	12	9.2	3	25.0	2.3	151.7	15	2
49/45 MPH HC or CO		≥ 200 ppm ≥ 1.5 % v	22	16.8	5	22.7	3.8	137.4	22	4

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.17

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

NOX CONTROLLED VEHICLES

HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	150	≤ - 80 rpm			26	17.3				
IDLE HC		≥ 225 ppm	66	44.0	17	25.8	11.3	-152.0	57	16
TIMING, dev. from Spec.	148	≥ 1.5°			42	28.4				
IDLE HC		≥ 225 ppm	66	44.6	23	34.8	15.5	4.24	2.7	22
49/45 MPH HC		≥ 200 ppm	31	20.9	9	29.0	6.1	4.89	3.2	8
PCV FLOW, measured	137	≤ 1.5 cfm			16	11.7				
IDLE CO		≥ 3.5 % v	55	40.1	9	16.4	6.6	1.168	0.36	8
49/45 MPH HC or CO		≥ 175 ppm, ≥ 1.0 % v	44	32.1	6	13.6	4.4	1.191	0.33	5
AIR CLEANER, measured	131	≥ 100°			14	10.7				
49/45 MPH HC		≥ 175 ppm	25	19.1	6	24.0	4.6	134.5	21	5
49/45 MPH HC or CO		≥ 175 ppm, ≥ 1.0 % v	42	32.1	10	23.8	7.6	136.5	23	9

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.18
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	130	≤ - 80 rpm			4	3.1				
IDLE HC		≥ 800 ppm	22	16.9	2	9.1	1.5	-152.5	38.9	1
TIMING, dev. from Spec.	124	≥ 1.5°			56	45.2				
IDLE HC		≥ 800 ppm	22	17.7	13	59.1	10.5	5.81	3.47	12
49/45 MPH HC		≥ 500 ppm	6	4.8	4	66.7	3.2	4.88	1.65	3
PCV FLOW, measured	88	≤ 1.5°			10	11.4				
IDLE CO		≥ 8.0 % v	17	19.3	0	0	0			
49/45 MPH HC or CO		≥ 500 ppm, ≥ 4.8 % v	10	11.4	0	0	0			
AIR CLEANER, measured	114	≥ 100°			25	21.9				
49/45 MPH HC		≥ 500 ppm	5	4.4	1	20.0	0.9	170.0		
49/45 MPH HC or CO		≥ 500 ppm, ≥ 4.8 % v	10	8.8	2	20.0	1.8	141.7	40.0	1

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.19

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	130	≤ - 80 rpm			4	3.1				
IDLE HC		≥ 675 ppm	33	25.4	3	9.1	2.3	-135.0	40.9	2
TIMING, dev. from Spec.	124	≥ 1.5°			56	45.2				
IDLE HC		≥ 675 ppm	33	26.6	21	63.6	16.9	6.62	3.85	20
49/45 MPH HC		≥ 400 ppm	14	11.3	6	42.8	4.8	4.25	1.72	5
PCV FLOW, measured	88	≤ 1.5°			10	11.4				
IDLE CO		≥ 6.7 % v	24	27.3	1	4.2	1.1			
49/45 MPH HC or CO		≥ 400 ppm, ≥ 2.8 % v	19	21.6	3	15.8	3.4	1.21	0.15	2
AIR CLEANER, measured	114	≥ 100°			25	21.9				
49/45 MPH HC		≥ 400 ppm	13	11.4	3	23.1	2.6	131.1	33.7	2
49/45 MPH HC or CO		≥ 400 ppm, ≥ 2.8 % v	23	20.2	4	17.4	3.5	138.4	31.1	3

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.20
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

PRE-EMISSION CONTROLLED VEHICLES

HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	130	≤ - 80 rpm			4	3.1				
IDLE HC		≥ 575 ppm	48	36.9	3	6.2	2.3	-135.0	40.9	2
TIMING, dev. from Spec.	124	≥ 1.5°			56	45.2				
IDLE HC		≥ 575 ppm	47	37.9	27	57.4	21.8	6.70	3.85	26
49/45 MPH HC		≥ 350 ppm	26	21.0	12	46.2	9.7	5.25	3.41	11
PCV FLOW, measured	88	≤ 1.5°			10	11.4				
IDLE CO		≥ 5.4 % v	35	39.8	2	5.7	2.3	0.65	0.92	1
49/45 MPH HC or CO		≥ 350 ppm, ≥ 2.3 % v	29	33.0	5	17.2	5.7	0.98	0.56	4
AIR CLEANER, measured	114	≥ 100°			25	21.9				
49/45 MPH HC		≥ 350 ppm	26	22.8	5	19.2	4.4	128.9	26.4	4
49/45 MPH HC or CO		≥ 350 ppm, ≥ 2.3 % v	37	32.4	8	21.6	7.0	129.9	25.7	7

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1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.21
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	127	≤ - 80 rpm			15	11.8				
IDLE HC		≥ 450 ppm	21	16.5	3	14.3	2.4	-125.0	43.3	2
TIMING, dev. from Spec.	125	≥ 1.5°			56	44.8				
IDLE HC		≥ 450 ppm	20	16.0	8	40.0	6.4	5.50	2.79	7
49/45 MPH HC		≥ 375 ppm	5	4.0	1	20.0	0.8	4.00		
PCV FLOW, measured	119	≤ 1.5°			9	7.6				
IDLE CO		≥ 5.7 % v	23	19.3	1	4.3	0.8	1.29		
49/45 MPH HC or CO		≥ 375 ppm, ≥ 2.8 % v	7	5.9	1	14.3	0.8	1.29		
AIR CLEANER, measured	118	≥ 100°			17	14.4				
49/45 MPH HC		≥ 375 ppm	5	4.2	0	0	0			
49/45 MPH HC or CO		≥ 375 ppm, ≥ 2.8 % v	7	5.9	0	0	0			

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.22
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	127	≤ - 80 rpm			15	11.8				
IDLE HC		≥ 325 ppm	36	28.3	3	8.3	2.4	-125.0	43.3	2
TIMING, dev. from Spec.	125	≥ 1.5°			56	44.8				
IDLE HC		≥ 325 ppm	33	26.4	13	39.4	10.4	4.81	2.49	12
49/45 MPH HC		≥ 275 ppm	17	13.6	3	17.6	2.4	3.33	1.15	2
PCV FLOW, measured	119	≤ 1.5°			9	7.6				
IDLE CO		≥ 4.6 % v	32	26.9	2	6.2	1.7	1.16	0.18	1
49/45 MPH HC or CO		≥ 275 ppm, ≥ 1.4 % v	25	21.0	4	16.0	3.4	1.23	0.13	3
AIR CLEANER, measured	118	≥ 100°			17	14.4				
49/45 MPH HC		≥ 275 ppm	18	15.2	2	11.1	1.7	149.2	22.3	1
49/45 MPH HC or CO		≥ 275 ppm, ≥ 1.4 % v	25	21.2	3	12.0	2.5	149.1	15.8	1

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.23
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

DETROIT VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
IDLE RPM, dev. from Spec.	127	≤ - 80 rpm			15	11.8				
IDLE HC		≥ 300 ppm	43	33.8	4	9.3	3.1	-125.0	35.4	3
TIMING, dev. from Spec.	125	≥ 1.5°			56	44.8				
IDLE HC		≥ 300 ppm	40	32.0	16	40.0	12.8	5.19	2.39	15
49/45 MPH HC		≥ 250 ppm	28	22.4	8	28.6	6.4	5.06	2.86	7
PCV FLOW, measured	119	≤ 1.5°			9	7.6				
IDLE CO		≥ 3.7 % v	46	38.6	3	6.5	2.5	1.21	0.15	2
49/45 MPH HC or CO		{≥ 250 ppm, ≥ 1.0 % v	37	31.1	4	10.8	3.4	1.23	0.13	3
AIR CLEANER, measured	117	≥ 100°			17	14.5				
49/45 MPH HC		≥ 250 ppm	29	24.8	4	13.8	3.4	132.2	24.8	3
49/45 MPH HC or CO		{≥ 250 ppm, ≥ 1.0 % v	37	31.1	6	16.2	5.1	134.6	20.5	5

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.24
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

LOW CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
AIR PUMP IDLE HC	35	≥ 400 ppm	4	11.4	7 2	20.0 50.0	5.7	—	—	—
AIR PUMP 49/45 MPH HC	35	≥ 350 ppm	1	2.8	7 1	20.0 100.0	2.8	—	—	—
AIR PUMP IDLE HC or CO	35	{≥ 400 ppm, ≥ 6.5 % v	6	17.1	7 2	20.0 33.3	5.7	—	—	—
AIR PUMP 49/45 MPH HC or CO	35	{≥ 350 ppm, ≥ 4.0 % v	1	2.8	7 1	20.0 100.0	2.8	—	—	—

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.25

SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

MID CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
AIR PUMP					7	20.0				
IDLE HC	35	≥ 350 ppm	6	17.1	2	33.3	5.7	—	—	—
AIR PUMP					7	20.0				
49/45 MPH HC	35	≥ 250 ppm	3	8.6	2	66.7	5.7	—	—	—
AIR PUMP					7	20.0				
IDLE HC or CO	35	≥ 350 ppm, ≥ 5.5 % v	7	20.0	2	28.6	5.7	—	—	—
AIR PUMP					7	20.0				
49/45 MPH HC or CO	35	≥ 250 ppm, ≥ 2.0 % v	10	28.6	3	30.0	8.6	—	—	—

1. Percent basis total set.
2. Percent basis rejected set.

TABLE 2.26
SUMMARY OF DISTRIBUTIONS PARTITIONED BY APPLYING DIAGNOSTIC CYCLE CUT POINTS

SAN BERNARDINO VEHICLE FLEET

EMISSION CONTROLLED VEHICLES

HIGH CUT POINT

PARAMETER/DIAGNOSTIC MODE	TOTAL SET	CUT POINT	REJECTED		FAILED		DETECTED			
			NO.	PERCENT[1]	NO.	PERCENT[2]	PERCENT[1]	$\overline{X}$	S	df
AIR PUMP					7	20.0				
IDLE HC	35	≥ 300 ppm	7	20.0	2	28.6	5.7	—	—	—
AIR PUMP					7	20.0				
49/45 MPH HC	35	≥ 225 ppm	4	11.4	2	50.0	5.7	—	—	—
AIR PUMP					7	20.0				
49/45 MPH HC or CO	35	{≥ 300 ppm, ≥ 4.5 % v	7	20.0	2	28.6	5.7	—	—	—
AIR PUMP					7	20.0				
49/45 MPH HC or CO	35	{≥ 225 ppm, ≥ 1.5 % v	14	40.0	3	21.4	8.6	—	—	—

1. Percent basis total set.
2. Percent basis rejected set.

FIGURE 2.45
ANALYSIS OF EMISSION SIGNATURE CUT POINT - TIMING

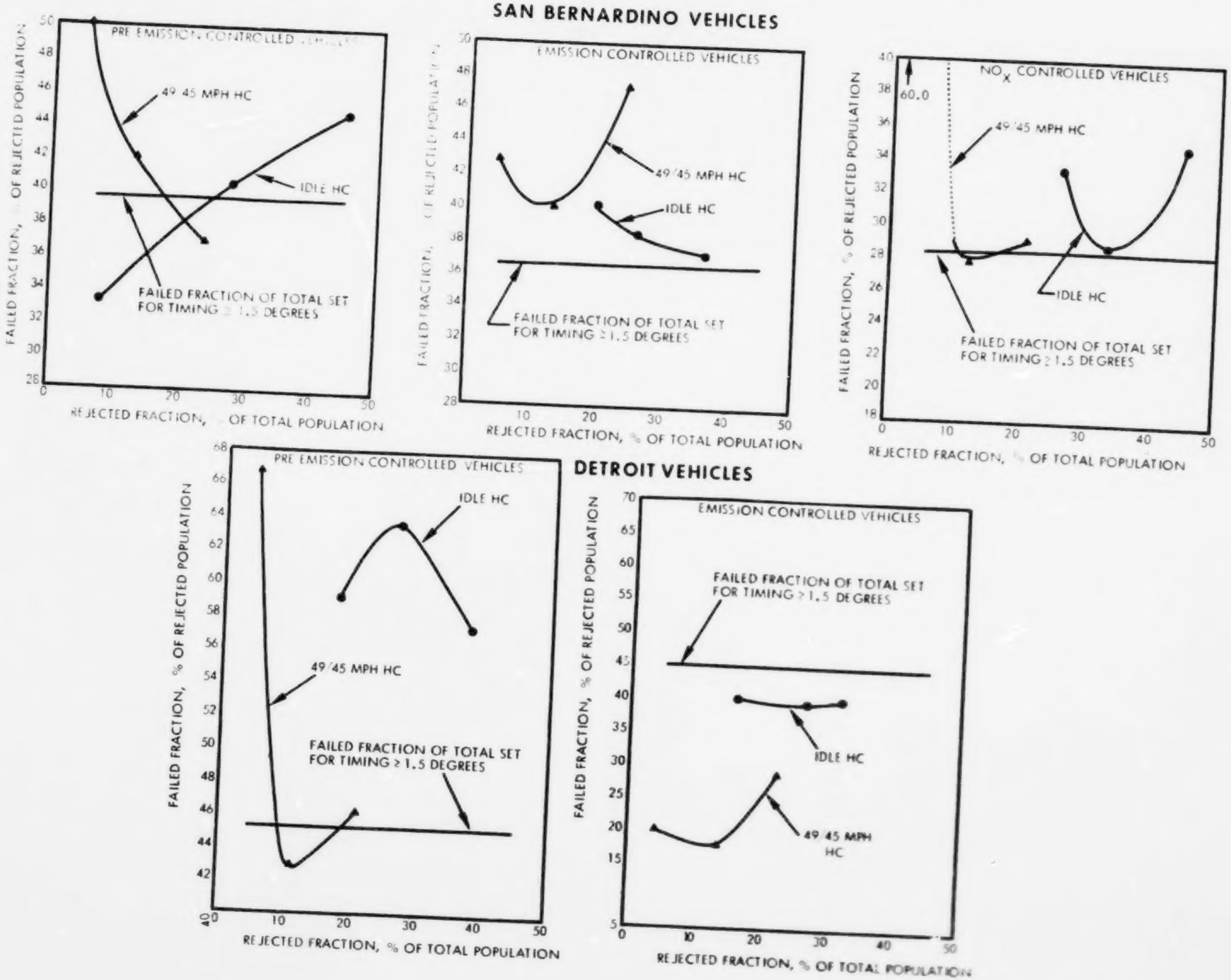
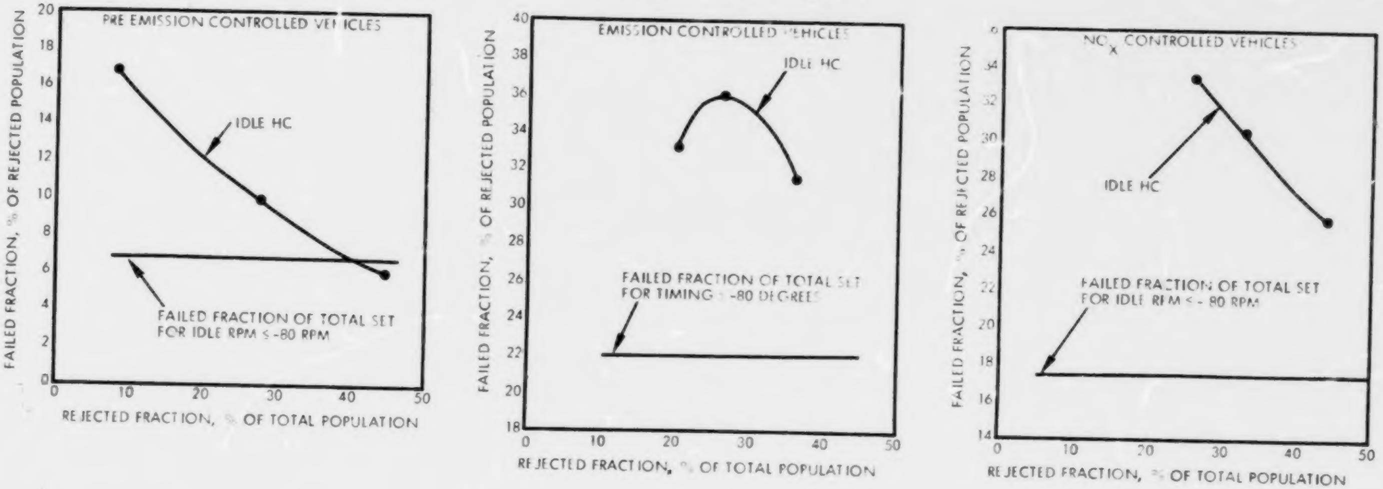


FIGURE 2.46

ANALYSIS OF EMISSION SIGNATURE CUT POINT - IDLE RPM

SAN BERNARDINO VEHICLES



DETROIT VEHICLES

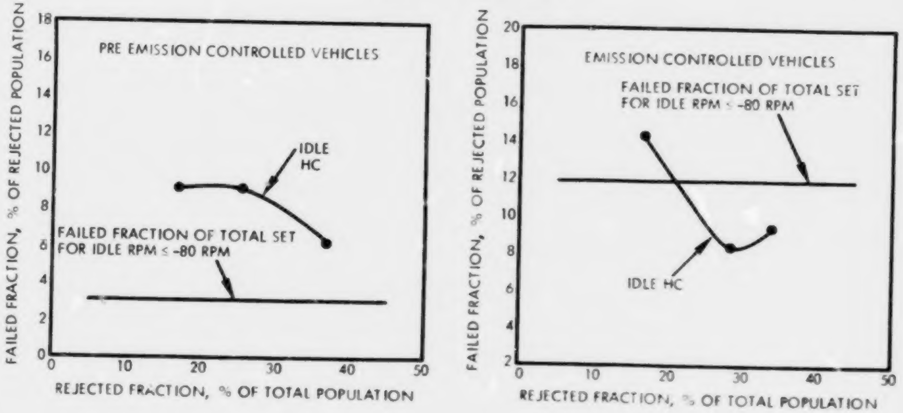
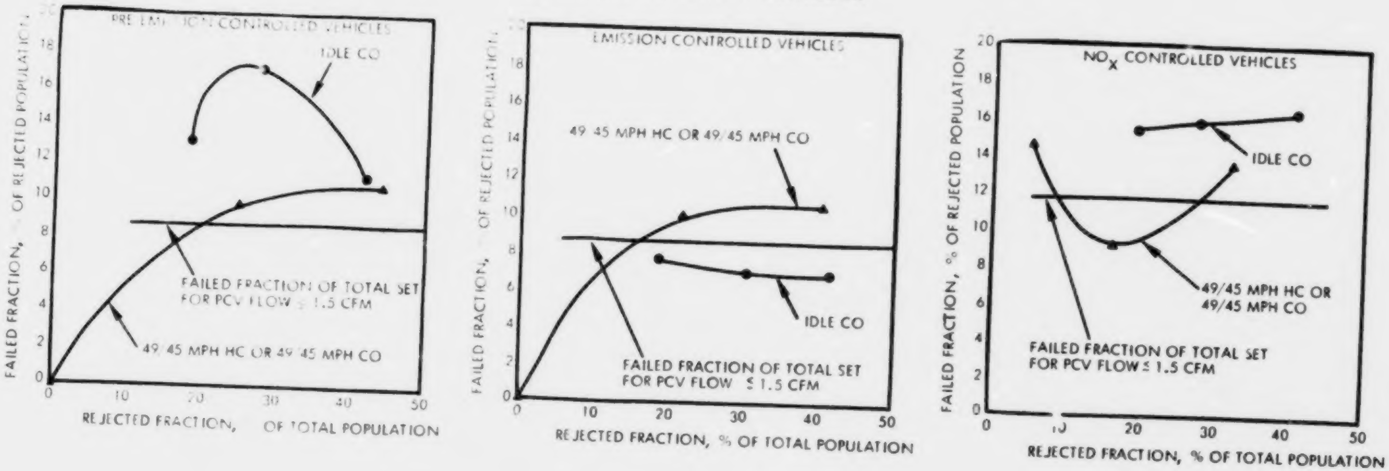


FIGURE 2.47
ANALYSIS OF EMISSION SIGNATURE CUT POINT - PCV FLOW

SAN BERNARDINO VEHICLES



DETROIT VEHICLES

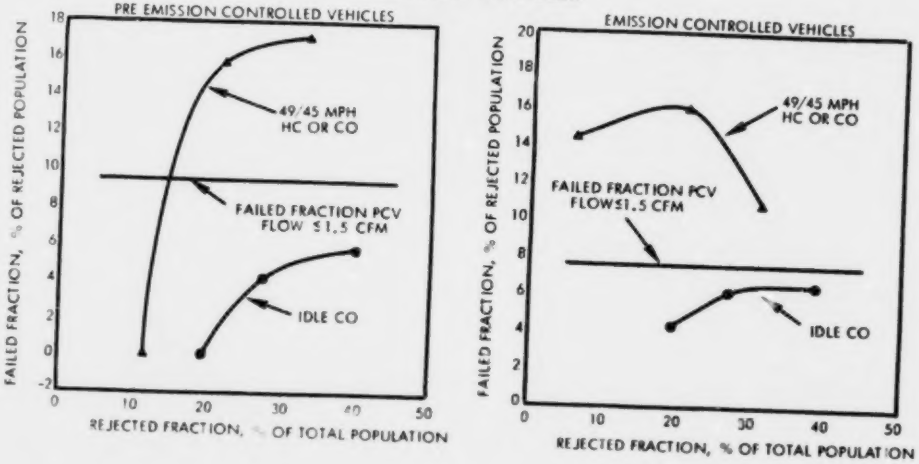
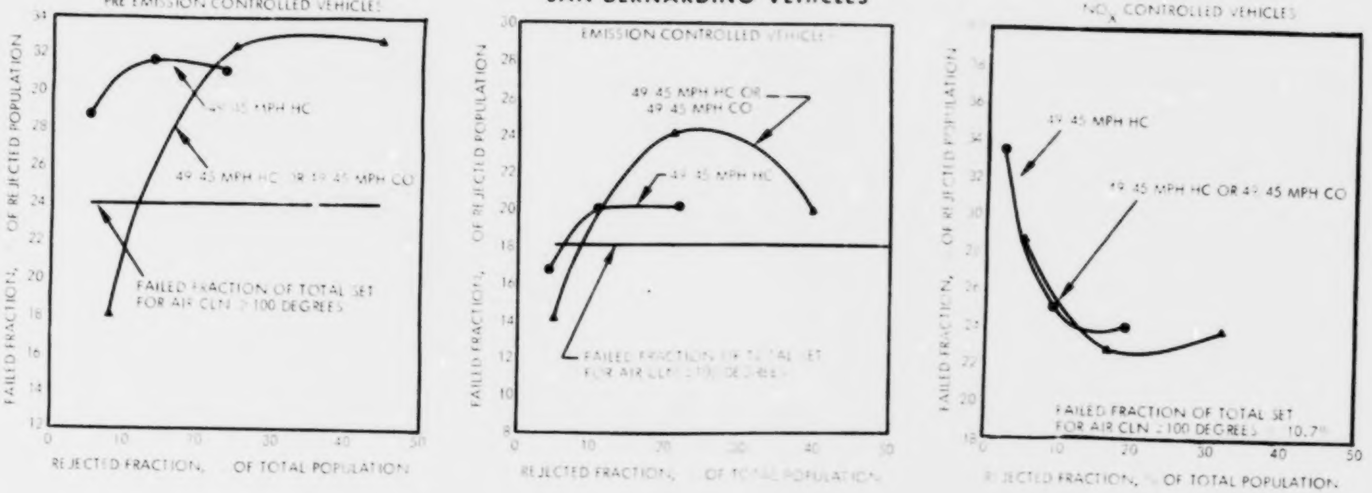


FIGURE 2.48

ANALYSIS OF EMISSION SIGNATURE CUT POINT - AIR CLEANER

SAN BERNARDINO VEHICLES



DETROIT VEHICLES

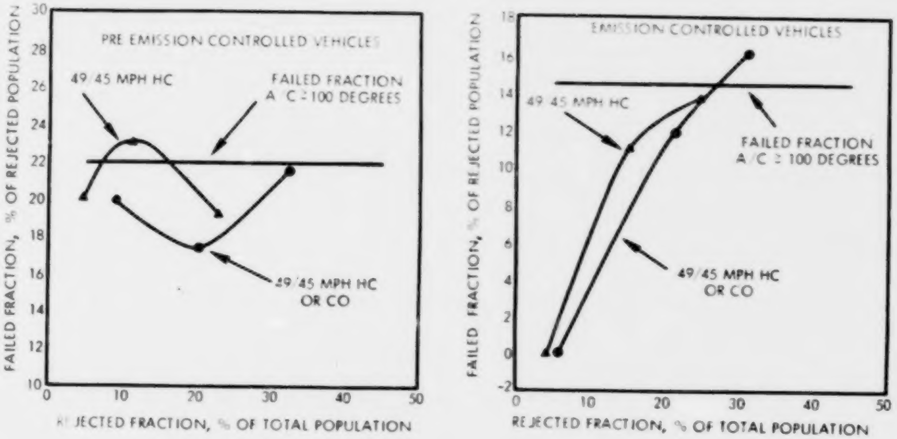
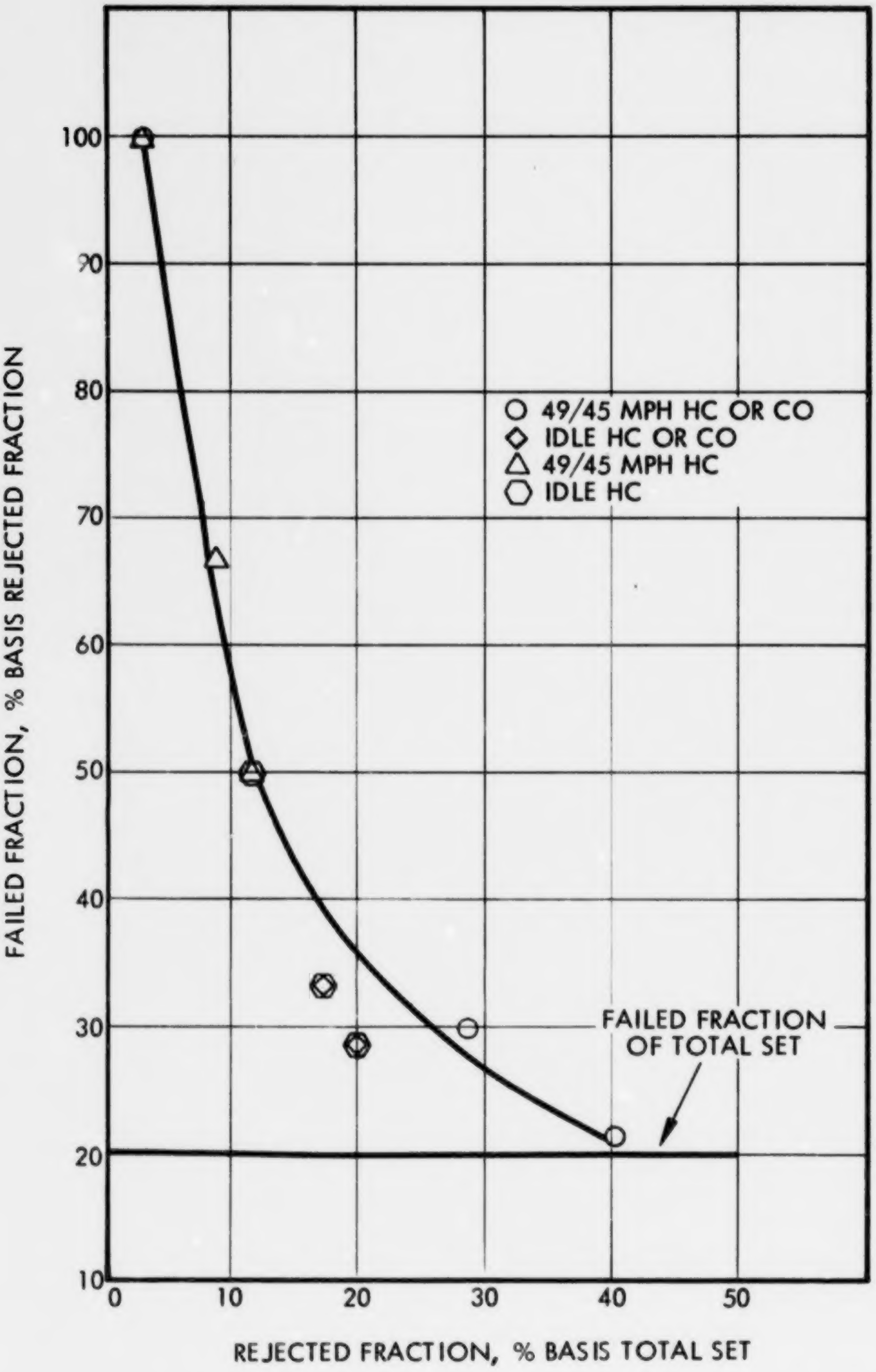


FIGURE 2.49

ANALYSIS OF EMISSION SIGNATURE CUT POINT - AIR PUMP



combination of (1) the extent of malfunction which are given in Tables 2.9 to 2.26, (2) the frequency of the parameters actually found to be failed of those rejected by the emission inspection, (3) the costs of inspection and repair, and (4) the potential emission reduction that can be attained with repair. The results do, however, clearly indicate the feasibility of using emission signatures and provide the fundamental data required to implement the economic effectiveness model. All of the vehicle fleets, with the exception of one, indicated failed fractions of basic timing, that were greater than the fraction maladjusted in the total set. For example, in Figure 2.46, the curve for pre-emission controlled vehicles, San Bernardino vehicles indicated that as the rejected fraction is increased using an idle HC emission signature, the failed fraction (>1.5 degrees advanced) in the rejected fraction increased from 33 to 45 percent. The failed fraction of the total set prior to partitioning by use of the emission signature was 39.6 percent. Therefore, the application of the emission signature marginally identifies timing advance. At lower levels of rejection (e.g., 10%) the loaded mode HC signature is usually more effective than the idle mode.

Correlations for Idle Speed, PCV Valve Flow Rate, and Air Cleaner Restriction are presented in Figures 2.46, 2.47 and 2.48. All of the parameters show comparable results and potentially effective emission signatures.

Idle HC inspection identifies slow idle speed malfunctions very effective relative to the actual maladjustments in the San Bernardino fleets. Maladjustments were defined to be idle speeds lower than manufacturers' specifications by more than 80 rpm. For the Detroit vehicles the emission signature was effective in identifying slow idle speed with the pre-emission vehicles, but was marginally effective with the emission controlled vehicles.

The identification of malfunction of PCV valve flow was investigated by using the Idle CO and combined HC or CO high cruise, as emission signatures. The results were different depending upon the vehicle fleet investigated, but the high load emission signatures resulted in better performance. In three of the vehicle fleets tested, i.e., emission controlled vehicles of San Bernardino and the two fleets of Detroit, the idle CO emission signature was ineffective in identifying restricted PCV. In these cases, PCV valve malfunctions may have been masked by low idle CO settings.

The results of the air cleaner parameter investigation, Figure 2.47, illustrate that for the San Bernardino vehicles both the HC and the combined HC and CO emission signature in the High Speed Cruise Mode were effective. In contrast, the same emission signatures applied to the Detroit vehicles proved ineffective.

The above results are generally consistent with the results of the statistically designed malfunction experiments, Section 3. In these experiments it was demonstrated that timing effects HC emissions in all operating modes, that idle speed predominately influences idle HC emissions and that carburetor metering upsets effected by restricted PCV systems or air cleaners predominately influence CO and HC emissions at high engine flow rates and loads. The consistently poor performance of these signatures in identifying malfunctions on emission controlled Detroit vehicles, is difficult to understand since failure rates are similar between these fleets and the equivalent (by emission control equipment rather than model year) San Bernardino fleets. The fact that the CO emissions in all modes are consistently lower in Detroit at a greater than 90 percent confidence level, suggests that the malfunctions may be more randomly distributed in this fleet. For example, a single malfunction in a vehicle might not be sufficient to fail it in a specific mode emission.

The diagnostic capability of several emission signatures was evaluated for identifying air pump malfunctions. The emission signatures were 49/45 mph HC, idle HC, 49/45 mph HC or CO, and idle HC or CO. The effectiveness of the emission signatures is depicted in Figure 2.49. All of the parameters were shown to be effective; however, the sample sets used for the analysis, i.e., a total set of 35 air pump vehicles containing 7 malfunctions, was too small to make definite conclusions although all of these signature inspections tend to be equally effective.

It has been assumed in the above discussion that those engine parameters related to the choke system and primarily affecting cold start emissions, are not identified by hot start emission signatures. Further, it has been assumed that the NO_x control (primarily a vacuum advance override) fails inoperative during high manifold vacuum, part load accelerations. Its failure, therefore, does not substantially influence cruise mode NO_x

emissions. Also, very few failures of this component were found in the engine parameters surveys, thus a valid, statistic for this device could not be developed.

The strategy which this analysis supports is one in which the emission signature is used to screen (partition) vehicle subsets which, in turn, would be further inspected by use of a parameter diagnostic procedure. The resulting subset would have a higher concentration of malfunction vehicles than the total population of vehicles. It is concluded that to this degree the use of emission signatures has the potential of being cost effective, particularly for those malfunctions which occur infrequently and are costly to diagnose using conventional equipment. It is clear, however, that inspection errors of omission and commossion will occur and that the approach can never be as effective as a direct diagnosis by skilled mechanics.

2.6.4 Emission and Engine Parameter Deterioration

The objective of the engine parameter and emission deterioration experiment is to quantitatively describe the rapidity with which these variables degrade from a known maintenance state. The experiment required testing vehicles by using conventional and specially developed diagnostic procedures and emissions tests.

The analysis approach that is applied may be different, depending upon the nature of the deterioration characteristic of any given variable. For example, a linearly varying parameter would simply require a linear regression to establish the deterioration rate. In contrast, a non-linear deterioration function may have an initial high rate of deterioration during a comparatively short period of time following by a period of minimum deterioration during a long period of time. The analysis was primarily directed at developing statistics associated with the changes that occurred during the first four months of the experiment. Because the experiment is incomplete, the reader is cautioned not to unduly weigh the current preliminary results until all of the experimental data has been assembled and systematically evaluated. In addition, critical review of the procedures followed during testing indicated that some of the vehicles were not cold soaked within the ambient temperature limits of 60°F to 80°F. Preliminary analyses suggest that the magnitude of the changes (emission increases) observed in the 1972 Federal Procedure emission measurements during the test period of operation will be less if the data of improperly soaked tests are adjusted for temperature differences. The data are presently being reviewed and auxiliary experimental tests are being conducted to further characterize the effects of cold soak temperature on emissions. The results of these analyses and experimental tests will be reported in the final report.

2.6.4.1 First Four Months Deterioration Period

The objective of this analysis was to characterize changes in emissions or engine parameters that occurred during the first deterioration period. To facilitate this analysis the estimates of the mean, standard deviation and degrees of freedom of that change that occurred during the first operating period followed vehicle initialization were developed. The actual data utilized in the analysis are presented in Appendix A. It is emphasized that the statistics are developed on the basis of the change that occurred by vehicle (i.e., mean of the differences) and are NOT the differences based upon population averaged values, i.e.,

$$\overline{\Delta X} = \sum_{i=1}^{N} \frac{(X_2 - X_{1B})_i}{N}$$

where:

X_{1B}, value of the variable immediately after maintenance
X_2, value of the variable after four months of field operation
N, vehicle fleet sample size

The results of the analyses, Table 2.27, are separated according to vehicle emission control type, i.e., pre-emission controlled (Fleet 1), emission controlled (Fleet 2), and NO_x controlled (Fleet 3). The data presented in Table 2.28 consist of only those parameters considered significant to the economic effectiveness model.

TABLE 2.27

CHANGE IN PARAMETER FROM TUNE CONDITION OVER FOUR MONTHS OF FLEET OPERATION
FIRST TEST PERIOD - TEST 2

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES					EMISSION CONTROLLED VEHICLES					NOX CONTROLLED VEHICLES				
	ΔX	S	d.f.	t	Significance	ΔX	S	d.f.	t	Significance	ΔX	S	d.f.	t	Significance
HC 72 COLD, g/mile	1.44	5.5	104	2.67	0.99	0.85	3.1	107	2.83	0.99	0.20	2.7	116	0.81	0.70
CO 72 COLD, g/mile	6.70	39	104	1.77	0.90	12.8	33	107	4.01	0.99	9.5	29	115	3.55	0.99
NOX 72 COLD, g/mile	-0.77	1.2	94	-5.97	0.99	-1.38	2.0	89	-6.73	0.99	-1.11	1.3	114	-8.89	0.99
NOXP 72 COLD, g/mile	0.183	0.72	26	1.32	0.80	-	-	0			-0.227	1.0	29	-1.24	0.70
HC D1 (49/45), ppm	-7.1	166	104	-0.44	<0.50	-15.5	53	106	-3.02	0.99	4.9	98	116	0.54	<0.50
CO D1 (49/45), % v	-0.39	1.6	104	-2.54	0.99	0.013	1.1	107	0.12	0.50	0.035	0.88	116	0.43	<0.50
NOX D1 (49/45), ppm	326	632	97	5.10	0.99	246.1	823	90	2.85	0.99	213	774	113	2.96	0.99
NOXP D1 (49/45),ppm	166	675	23	1.20	0.70	-	-	0			212	509	30	2.32	0.99
HC D3 (Idle), ppm	-12.6	464	104	-0.28	<0.50	30.8	315	107	1.02	0.70	0.7	106	116	0.07	<0.50
CO D3 (Idle), % v	0.38	2.7	104	1.44	0.85	0.27	2.4	107	1.16	0.70	0.06	2.0	115	0.31	<0.50
NOX D3 (Idle), ppm	9.4	75	96	1.23	0.70	11.3	97	90	1.11	0.70	12.8	70	113	1.97	0.90
NOXP D3 (Idle), ppm	-9.61	69	22	-0.68	0.50	-	-	0			- 70	333	29	-1.15	0.70
TIMING, degrees	0.143	4.1	104	0.36	<0.50	-0.065	2.9	107	-0.23	<0.50	0.004	3.2	116	.014	<0.50
IRPM, rpm	17.9	89	103	2.06	0.99	-4.9	83	107	-0.62	0.50	5.8	73	118	0.86	0.50
AIR CLN ANGLE, degrees	25.1	44	95	5.58	0.99	19.2	31	96	6.02	0.99	15.0	25	106	6.12	0.99
PCV FLO D1, cfm	0.15	1.3	88	1.11	0.75	0.466	0.60	99	7.73	0.99	0.50	1.0	106	5.07	0.99
CH KICK, in	0.0014	0.010	56	1.06	0.70	-0.0086	0.050	93	-1.68	0.90	-0.0126	0.044	100	-2.87	0.99
HEAT RISER, % failed	37.1	-	61	-	-	29.7	-	63	-	-	0.0	-	21	-	-
VACUUM DIAPH, % failed	0.0	-	18	-	-	1.4	-	70	-	-	2.2	-	99	-	-
AIR PUMP, % failed	-	-	-	-	-	0	-	35	-	-	-	-	-	-	-
NOX CONTROL, % failed	-	-	-	-	-	-	-	-	-	-	6.1	-	65	-	-
MISFIRE D1 (49/45), %	0.2248	-	104	-	-	0.0	-	109	-	-	0.0639	-	118	-	-
MISFIRE D2 (30/33), %	0.3410	-	104	-	-	0.0	-	109	-	-	0.0521	-	118	-	-
MISFIRE D3 (Idle), %	0.2467	-	104	-	-	0.0	-	109	-	-	0.0361	-	118	-	-
MILEAGE, miles	3660	3092	104	-	-	4682	2134	108	-	-	5713	2759	117	-	-

It should be noted that the partitioning of the vehicle sets, by emission control type results in fleets of differing average age. The average mileage accumulation over a four month period of pre-emission controlled vehicles, for emission controlled vehicles and NO_x controlled vehicles were, respectively, 3660, 4682 and 5713.

Approximately one-half of the parameters investigated indicated average changes that were statistically significant at confidence levels of 90 percent or better. The most consistent set of parameters, as expected, were the emissions changes measured by the 1972 Federal Procedure. The increase in the HC emissions was greatest for the pre-emission controlled vehicles and the 1971 NO_x controlled vehicles showed no significant change. Carbon monoxide and NO_x measured by this procedure, however, indicated significant changes with all vehicle sets, the newer vehicles tending to deteriorate less rapidly.

The changes in the emissions in the Clayton high cruise mode (49/45 MPH cruise) and idle mode were less consistent than were the results obtained using the 1972 Federal CVS Procedure. There were comparatively fewer cases of statistically significant changes and in many cases overall average emission reductions were observed. The lack of consistency, although unexpected, may be due to the poorer repeatability of single mode emission measurements. The Federal Procedure results in a longer period of emission accumulation together with a larger number of individual modes which, over the test cycle would reduce the variability in the data.

The mean deterioration rates of engine malfunction parameters indicate trends which are consistent with generally accepted failure modes. For instance, basic timing, which is a fundamentally stable parameter, showed no significant mean change, although a trend of advancing timing with mileage accumulation is indicated. Idle RPM, which is considered less stable, indicated an increase in mean value for pre-emission controlled vehicles, but did not show a significant change with either of the emission controlled vehicle fleets. However, the dispersion in both of these parameters (i.e., their standard error) increased substantially and in both directions with mileage. Timing positive and negative dispersions are difficult to understand, although the result suggests that perhaps two opposing malfunction modes are simultaneously occurring (e.g., timing point and cam follower wear). The dispersion in idle speed is more easily explained since it is highly influenced by idle mixture which is also indicated to be highly variable. Idle mixture is directly influenced by carburetor deposits and indirectly effected by PCV valve performance, intake manifold vacuum leaks, etc.

The enrichment of idle fuel-to-air ratio as measured by CO (D3 Idle) is clearly indicated with mileage accumulation. It is most severe with older vehicles. The rate of deterioration for the uncontrolled vehicle fleet is respectively 2 and 10 times that measured with emission and NO_x controlled vehicle fleets. The higher rate on older vehicles may be attributable to using poorer, non-detergent grades of fuels and to a long time history of deposit build up in the carburetor metering sections (venturi and fuel ports). It should be recalled that carburetor replacement or repair was only performed when clear indications of fuel-to-air upset were observed. Thus, many vehicles were initialized with their recent deposit history undisturbed.

Substantial numbers of heat riser exhaust valves became inoperative during the first test period, exceeding 30 percent for Fleet 1. Clearly, a better maintenance procedure than freeing and lubricating is required to improve repair durability.

The air cleaner element would be expected to degrade and the results of all vehicle fleets indicate an increase in the restriction. The other parameters such as choke kick, misfire and various control parameters show that deterioration to some degree occurred during this first period of operation but the mileage accumulation is considered too low to indicate statistically significant results. The data does show, however, that the failure rates of vacuum diaphragm, air pump and NO_x control devices may be substantial and that larger fractions would be expected to fail during subsequent testing intervals.

On the basis of the average changes that occurred during the first period, preliminary estimates of the deterioration rate were developed by dividing the observed mean difference change, Equation 2.1, by the average accumulated mileage of each fleet.

$$\frac{\partial X}{\partial M} = \frac{\overline{\Delta X}}{\Delta M}$$

where:

$\partial X/\partial M$, estimated deterioration rate

ΔM, average accumulated mileage by fleet, Table 2.27

The estimated deterioration rates, Table 2.28, were not used directly in the economic effectiveness study because of the preliminary nature of the results. Rather, they were used with the previous year's deterioration rate data to estimate rates for pre-emission controlled and NO_x controlled vehicles.

2.6.4.2 Conclusions

The above discussion, although highly preliminary, suggests that significant mass emissions increases have occurred over the first four month durability period. However, these emissions changes are not confirmed by the corresponding engine parameter changes observed. Engine parameter trends, particularly those which have substantial influences on emissions, do, however, confirm the trend of the mass emission. For example, timing has become more advanced, air cleaners are more restricted; and ignition systems malfunctions are causing intermittent misfire. Several engine parameters have, however, indicated negative deteriorations which would be expected to cause emission decreases and contrary to the direction anticipated. PCV flow rate became slightly less restrictive and on two vehicle fleets idle speed increased slightly.

Mass emissions measured from a hot start using the EPA Short Cycle show less deterioration and can be better explained by the corresponding engine parameter changes. A detailed analysis of the data is currently underway to define the causes of these data anomolies. Suspected causes under investigation are:

1) Inadequate editing of the data for uncontrolled or undefined outside vehicle owner maintenance.
2) Data reduction or transcription errors in the data management process.
3) Systematic test procedure errors.

TABLE 2.28
ESTIMATED DETERIORATION RATES

		PRE-EMISSION CONTROLLED VEHICLE SLOPE	EMISSION CONTROLLED VEHICLE SLOPE	NOX CONTROLLED VEHICLE SLOPE
PARAMETERS		MEANS TEST (2-1B)	MEANS TEST (2-1B)	MEANS TEST (2-1B)
HC 72 COLD	g/mile/mile	3.934×10^{-4}*	1.815×10^{-4}*	0.3501×10^{-4}
CO 72 COLD	g/mile/mile	18.31×10^{-4}*	27.34×10^{-4}*	16.63×10^{-4}*
NOX 72 COLD	g/mile/mile	-2.104×10^{-4}*	-2.947×10^{-4}*	-1.943×10^{-4}*
NOXP 72 COLD	g/mile/mile	0.500×10^{-4}	-	-0.3973×10^{-4}
HC D1 (49/45)	ppm/mile	-19.40×10^{-4}	-33.10×10^{-4}*	8.577×10^{-4}
CO D1 (49/45)	% v/mile	-1.066×10^{-4}	0.02776×10^{-4}	0.06126×10^{-4}
NOX D1 (49/45)	ppm/mile	890.7×10^{-4}	525.6×10^{-4}*	376.3×10^{-4}*
NOXP D1 (49/45)	ppm/mile	453.6×10^{-4}	-	371.1×10^{-4}
HC D3 (Idle)	ppm/mile	-34.43×10^{-4}	65.78×10^{-4}	1.225×10^{-4}
CO D3 (Idle)	% v/mile	1.038×10^{-4}	0.5767×10^{-4}	0.1050×10^{-4}
NOX D3 (Idle)	ppm/mile	25.68×10^{-4}	24.13×10^{-4}	22.40×10^{-4}*
NOXP D3 (Idle)	ppm/mile	-26.26×10^{-4}	-	-122.5×10^{-4}
TIMING	degrees/mile	0.3907×10^{-4}	-0.1388×10^{-4}	0.0070×10^{-4}
IRPM	rpm/mile	48.41×10^{-4}	-10.46×10^{-4}	10.15×10^{-4}
AIR CLN ANGLE	degrees/mile	68.58×10^{-4}*	41.01×10^{-4}*	26.26×10^{-4}*
PCV FLO D1	cfm/mile	0.4098×10^{-4}	0.9953×10^{-4}*	0.8752×10^{-4}*
CH KICK	in/mile	0.01202×10^{-4}	-0.0184×10^{-4}	-0.0220×10^{-4}*
MISFIRE D1 (49/45)	%/mile	1.938×10^{-4}	0.0	0.1118×10^{-4}
MISFIRE D2 (33/30)	%/mile	2.146×10^{-4}	0.0	0.0912×10^{-4}
MISFIRE D3 (Idle)	%/mile	1.829×10^{-4}	0.0	0.0632×10^{-4}

*Values were found to be significant at levels equal to and greater than 90 percent.

4) Uncontrolled external influence such as diurninal ambient temperature and humidity excursions.

5) Effect of vehicle cold soak temperature on 1972 Federal Procedure emission levels.

It is likely that some of the above influences will explain part of the data discrepancy, but that the emission changes will remain abnormally large. It should be noted, however, that undue weighting is currently being placed on this test period. The data from subsequent test intervals will permit the application of non-linear regression analyses which will tend to unweight the current data as well as permit a greater variety of statistical analyses with large data sets which will tend to effect higher confidence levels.

2.6.5 Misfire

As a part of the experiments in which the parameter deterioration rates of California vehicles and parameter distributions of Detroit vehicles were investigated, quantitative measurements of misfire were made while operating the vehicle in three modes of the Clayton cycle. Criteria were established by Scott to measure the misfire rate in each of these modes by observing the ignition firing lines indicated on the oscilloscope of a commercial electronic ignition analyzer. This data on "as received" vehicles prior to tune-up, indicated comparatively low rates of misfire. Based upon the previous year's program, Reference 10, approximately 5 percent of the pre-emission controlled vehicles (Fleet 1) were anticipated to have measurable misfire. The results indicated misfire rates of approximately 2 percent. In addition, review of the HC emission data as measured in the Clayton keymodes indicated clear signatures of misfire was not detected with the electronic analyzer. An investigation was, therefore, undertaken to develop an alternative means for measuring misfire.

Discussions with representatives of diagnostic equipment manufacturers and spark plug manufacturers indicated that the quantitative measurement of misfire by use of an oscilloscope was difficult to obtain and not always reliable. An auxiliary experiment was therefore undertaken to measure the effect of a known amount of an imposed misfire on emissions. The results of these tests are presented in Table 2.29. Three Chevrolet vehicles

TABLE 2.29

ANALYSIS OF SPARK PLUG MISFIRE

			71 CHEVROLET (12.5% MISFIRE)				70 CHEVROLET (12.5% MISFIRE)				65 CHEVROLET (12.5% MISFIRE)				71 GREMLIN (16.7% MISFIRE)				RESPONSE COEFFICIENT STATISTICS			
			MISFIRE	NORMAL	Δ	RESPONSE ΔE/ΔP	MISFIRE	NORMAL	Δ	RESPONSE ΔE/ΔP	MISFIRE	NORMAL	Δ	RESPONSE ΔE/ΔP	MISFIRE	NORMAL	Δ	RESPONSE ΔE/ΔP	$\overline{X}$	S	d.f.	t
FEDERAL HC	72	g/mile	33.50	4.15	29.35	2.35	26.05	4.02	22.03	1.76	32.07	9.67	22.40	1.79	31.52	2.15	27.37	1.76	1.915	0.29	3	13.21*
	75	g/mile	30.02	3.48	26.54	2.12	23.73	3.52	20.21	1.62	27.47	8.22	19.25	1.54	28.76	1.68	27.08	1.62	1.725	0.27	3	12.78*
FEDERAL CO	72	g/mile	64.33	51.89	12.44	0.995	32.24	28.75	3.49	0.28	109.29	110.97	-1.68	-0.13	15.69	40.07	-24.38	-1.46	-0.079	1.03	3	-0.15
	75	g/mile	55.84	44.11	11.73	0.938	25.71	25.77	-0.06	-0.0048	87.06	94.17	-7.11	-0.57	19.71	32.16	-12.45	-0.74	-0.094	0.76	3	-0.25
FEDERAL NOX	72	g/mile	5.54	4.34	1.20	0.096	6.34	5.70	0.64	0.0512	2.29	2.64	-0.35	-0.026	3.29	4.07	-0.78	-0.0467	0.018	0.07	3	0.51
	75	g/mile	5.00	4.19	0.81	0.0648	6.18	5.32	0.86	0.0688	2.31	2.56	-0.25	-0.020	3.90	3.81	0.09	0.00539	0.030	0.04	3	1.5
EPA SHORT	HC	g/mile	23.05	2.49	20.56	1.64	18.15	2.81	15.34	1.23	20.00	6.20	13.80	1.104	22.06	0.79	21.27	1.27	1.31	0.23	3	11.39*
	CO	g/mile	36.17	33.27	2.90	0.23	17.75	20.15	-2.40	-0.19	58.25	71.21	-12.76	-1.104	12.50	18.09	-5.59	-0.33	-0.333	0.53	3	-1.26
	NOX	g/mile	3.58	3.52	0.06	0.0048	4.44	3.86	0.58	0.0464	1.74	1.88	-0.14	-0.0112	2.67	2.39	0.28	0.0168	0.014	0.02	3	1.4
49/45 MPH (D1)	HC	ppm	1290	89	1201	96.08	1756	145	1611	128.9	2069	258	1811	144.9	1909	68	1841	110.2	120.0	21	3	11.42*
	CO	%v	0.77	0.52	0.25	0.02	0.23	0.20	0.03	0.0024	1.36	2.38	-1.02	-0.082	0.64	0.20	0.44	0.0263	-0.008	0.49	3	-0.03
	NOX	ppm	1944	2452	-508	-40.6	3316	3951	-635	-50.8	2127	1823	304	24.3	2361	3659	-1298	-77.9	-36.25	43.3	3	-1.67
33/30 MPH (D2)	HC	ppm	1452	159	1293	103.4	1756	159	1597	127.8	2206	433	1773	141.8	1741	27	1714	102.6	118.9	19	3	12.52*
	CO	%v	1.41	1.68	-0.27	-0.0216	0.23	0.14	0.09	0.0072	3.99	5.29	-1.30	-0.104	0.11	0.11	0	0	-0.030	0.05	3	-1.2
	NOX	ppm	1401	1322	79	6.32	2050	2000	50.00	4.00	736	538	198	15.9	1082	860	222	13.3	9.880	5.63	3	3.51*
IDLE (D3)	HC	ppm	1616	194	1422	113.8	1979	152	1827	146.2	2251	531	1720	137.6	2298	145	2153	128.9	131.6	14	3	18.8*
	CO	%v	2.06	1.50	0.56	0.0448	1.50	0.67	0.83	0.0664	2.17	4.16	-1.99	-0.16	2.33	4.25	-1.92	-0.115	-0.041	0.11	3	-0.75
	NOX	ppm	334	218	116	9.28	203	218	-15.00	-1.20	115	112	3.00	0.240	258	129	127	7.74	4.015	5.26	3	1.53

*Data significantly different at 95 percent confidence level.

representing the pre-emission controlled, emission controlled and NO_x controlled vehicles were tested. In addition, a '71 Gremlin was tested to illustrate the difference that could result with an engine with lesser number of cylinders, or with different vehicle types. The misfire that resulted with one cylinder electrically inoperative was developed with each of the vehicles. Emissions were measured with the '72 and '75 Federal Procedures, together with EPA Short, and the three Clayton cycles. Differences in the emission levels, principally HC, with and without engine misfire were developed from this data. The responses computed for each of the vehicles tested are summarized in Table 2.29.

The results confirmed the hypothesis that hydrocarbon emissions are a good indicator of misfire. The responses in terms of HC emissions were statistically significantly different from zero in all tests. There was only one case in which a CO or NO response was statistically significant. A review of the data presented in Table 2.29 indicates that when one cylinder is totally misfiring during all modes the HC emission responses to misfire are: 1) similar for all of the cycles and, 2) similar between test vehicles. In the case of incipient or sporadic misfire, the effect of misfire on the emissions would be expected to be less dramatic and will be manifested by random increases in HC emissions rather than by systematic increases in the steady state concentration levels. This approach will therefore be ineffective in detecting incipient or sporadic misfire. Rather than an increasing rate of misfire with the heavier loaded midrange and high cruise modes which most investigators suggest, the statistics associated with misfire by the nature of the approach used to identify misfire will tend to indicate somewhat constant misfire rates across all modes.

HC mass emission response coefficients were largest for the 1971 vehicle which, conversely, had the smallest NDIR HC concentration response. It is possible that the retarded timing in the acceleration modes due to the NO_x control device is causing this anomaly. This vehicle also had a substantial CO mass emission response to misfire, substantiating the poor burn out of unreacted fuel in the exhaust manifold. The emission responses otherwise are remarkably similar considering the different basic timing, distributor vacuum advance profiles and exhaust systems represented by this diverse group of control systems and engine configurations.

Because of the clear sensitivity of HC emissions to misfire and also the consistency of the misfire response coefficients, it was concluded that the responses as measured in the three Clayton cycles could be used to predict the misfire rate of any test vehicle. The misfire rate under various engine loads was therefore developed on the basis of the measured change in the pre and post maintenance HC emission using the Clayton keymode cycles. For the Detroit vehicle population where maintenance was not performed, the misfire rate was developed on the basis of the difference between the HC emissions of this fleet and the average value obtained with the comparable fleet tested in San Bernardino. All HC emissions changes were first corrected for deviate timing adjustments which were routinely made during maintenance and which have a substantial impact on emissions.

The functional relation used to develop misfire from HC measurements while operating the vehicle in the Clayton keymode cycles is defined below:

$$\%\ \text{misfire} = \frac{\Delta HC - \dfrac{\partial HC}{\partial\ \text{timing}}\ \Delta\text{timing}}{\partial HC/\partial\ (\%\ \text{misfire})}$$

where:

ΔHC, change in emissions resulting from total maintenance

Δtiming, change in ignition timing resulting from maintenance

$\partial HC/\partial$timing, response coefficient for timing derived from the orthogonal tests (Section 3)

$\partial HC/\partial$%misfire, response coefficient for ignition misfire

A comparison of misfire as measured by use of the scope and the misfire computed from the HC emission signatures is presented in Table 2.30. The total number of cases in which misfire was detected by use of the HC emission signatures was not markedly greater than the number of cases in which misfire was measured utilizing the oscilloscope. However, misfire was detected using both methods in only 20 percent of the cases. The results clearly indicate that from a statistical standpoint, neither method could be considered more effective than the other. The tests with known misfire rates clearly indicate that misfire would be manifested in the emission levels and for this reason it is concluded that misfire rates computed by use of the HC emission signatures would result in internally more consistent data. Clearly, improved methods for detecting misfire rates are needed in commercial repair agencies.

TABLE 2.30

SUMMARY OF MISFIRE OF VEHICLES PRIOR TO ENGINE TUNE

SCOPE VS. KEY MODE HC EMISSIONS

TEST NO. 1A

			MISFIRE, %					
			MEASURED - SCOPE			DETECTED - HC		
	FLEET NO.	CAR NO.	49/45 MPH CRUISE	33/30 MPH CRUISE	IDLE	49/45 MPH CRUISE	33/30 MPH CRUISE	IDLE
SAN BERNARDINO VEHICLES	1	4	3.0	4.0	4.0	0	0	0
		6	4.0	4.0	3.0	0	0	0
		22	0	0	0	6.4	11.4	4.1
		24	0	0	0	2.1	5.5	9.4
		40	0	0	0	11.1	12.6	36.6
		41	0	5.0	0	0	0	0
		69	0	0	0	13.9	19.4	24.4
		95	12.0	0	12.0	12.8	13.6	12.1
		139	0	0	0	4.0	5.2	8.8
		142	5.0	0	0	0	0	0
		144	12.5	12.5	12.5	35.9	33.1	27.3
	2	164	0	0	0	2.2	2.4	21.4
		197	0	0	0	2.7	2.6	2.1
		214	12.0	12.0	12.0	0	0	0
		259	0	0	0	3.0	8.8	10.9
		266	4.0	4.0	0	0	0	0
		274	12.0	12.0	12.0	0	0	0
	3	345	0	0	25.0	0	0	0
DETROIT VEHICLES	1	1159	12.5	12.5	12.5	16.8	15.3	7.4
		1187	0	0	0	12.3	12.9	14.7
		1190	0	0	0	15.3	17.1	14.2
		1255	12.5	12.5	12.5	15.0	13.9	16.8
		1259	12.5	12.5	12.5	13.0	16.3	16.2
		1260	25.0	25.0	25.0	0	0	0
	2	1009	8.0	8.0	8.0	0	0	0
		1039	12.5	12.5	12.5	0	0	0
		1050	0	0	0	4.4	3.1	4.8
		1201	12.5	12.5	12.5	5.0	6.5	3.5

2.6.6 Investigation of Differences in Idle CO Measurements by Two Procedures

During the course of the deterioration test, discrepancies were noted between the floor measurement of Idle CO made while adjusting idle carburetion and those made during the post-maintenance emission tests. The Idle CO measurements taken during the final Idle mode of the Clayton cycle indicated values significantly larger than those set during maintenance (i.e., to manufacturers' specifications). For example, the average idle specification setting for 1971 vehicles is approximately one percent. The results of the post-tune keymode tests for the NO_x controlled vehicles (Fleet 3) indicated an average CO measurement of 2.82 percent CO, significantly different from one percent achieved with the floor setting. Since the potential validity of a keymode inspection for diagnosing idle mixture is in question relative to this data, a detailed analysis was initiated.

Cursory reviews of the data were made to determine if the high values of Idle CO were due to deviations of particular makes or models of vehicles. Analysis by partitioning the data into various subsets indicated no clear statistical trend. Also, review of the procedures followed by the mechanics in the tune-up process revealed no discrepancies. Further investigation was therefore directed toward evaluating the differences between the instruments and the associated procedures used in the two Idle CO measurement methods, i.e., measurement mode during engine tune (floor) as compared to the measurement mode during the Clayton keymode test.

In order to verify that the discrepancies observed in the Idle CO were not due to CO instrument biases, direct comparisons of the meter used in the floor measurements and the instrument used during the keymode tests were made. Comparative data taken with the standard NDIR instrument used in emission testing and the Horiba MEX-200 Motor Vehicle Exhaust Gas Analyzer used to set the air fuel mixture during engine maintenance are presented in Table 2.31. Data were partitioned into five groups according to the CO concentration level starting from a group with range 0 to 1% v, and increasing in units for each group to a final group with a concentration range of 4 to 5% v. The absolute value of the biases ranged from 0.03 to 0.33% v for the five groups or 4 to 8% of reading. Magnitude of the discrepancy was far less than what was necessary to explain the difference between the measured

TABLE 2.31

DIRECT COMPARISON OF INSTRUMENTS USED TO MEASURE CO

$0 \leq CO < 1$			$1 \leq CO < 2$			$2 \leq CO < 3$			$3 \leq CO < 4$			$4 \leq CO < 5$		
NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v
0.17	0.14	0.03	1.79	1.80	-0.01	1.98	2.15	-0.17	3.28	3.20	0.08	4.09	4.15	-0.06
0.17	0.13	0.04	1.51	1.60	-0.09	2.23	2.20	0.03	3.63	3.65	-0.02	4.00	4.15	-0.15
0.23	0.18	0.05	1.14	1.25	-0.11	2.70	2.00	0.70	3.72	3.90	-0.18	4.89	4.65	0.24
0.23	0.20	0.03	1.37	1.55	-0.18	2.31	2.50	-0.19	3.54	3.60	-0.06	4.58	4.80	-0.22
0.14	0.12	0.02	1.10	1.15	-0.05	2.70	2.80	-0.10	3.32	3.60	-0.28	4.19	4.70	-0.51
0.17	0.13	0.04	1.44	1.05	0.39	2.54	2.20	0.34	3.63	4.35	-0.72	4.00	4.50	-0.50
0.12	0.12	0	1.37	1.00	0.37	2.70	3.10	-0.40	4.00	3.50	0.50	4.28	4.90	-0.63
0.12	0.12	0	1.65	1.50	0.15	2.16	1.90	0.26	3.45	3.50	-0.05	4.09	4.00	0.09
0.15	0.12	0.03	1.79	1.45	0.34	2.86	2.50	0.36	3.54	3.80	-0.26	3.81	4.85	-1.04
0.12	0.12	0	2.23	1.65	0.58	2.31	2.15	0.16	3.28	3.35	-0.07	4.28	4.70	-0.42
0.12	0.10	0.02	1.24	1.00	0.24	2.86	2.90	-0.04	3.11	3.20	-0.09	4.28	4.65	-0.37
0.29	0.27	0.02	1.04	1.10	-0.06				3.72	3.80	-0.08	4.00	4.40	-0.40
0.59	0.40	0.19	1.24	1.15	0.09				3.81	4.15	-0.34			
0.35	0.15	0.20	1.72	1.75	-0.03									
0.66	0.50	0.16	1.10	1.00	0.10									
0.66	0.63	0.03	1.17	1.10	0.07									
1.04	0.85	0.19	1.04	0.90	0.14									
0.72	0.70	0.02	1.37	1.30	0.07									
0.66	0.65	0.01	1.65	0.55	0.10									
0.66	0.60	0.06	1.51	1.80	-0.29									
0.66	0.70	-0.04	1.72	1.80	-0.08									
0.85	0.70	0.15	1.10	1.00	0.10									
0.59	0.70	-0.11	1.10	1.10	0									
0.85	0.92	-0.07	2.31	1.40	0.91									
0.41	0.30	0.11	0.91	1.80	-0.89									
0.78	0.90	-0.12	2.08	1.45	0.63									
0.35	0.40	-0.05	1.95	1.30	0.45									
0.32	0.20	0.12	1.37	1.20	0.17									
0.17	0.20	-0.03	1.65	1.00	0.65									
0.17	0.10	0.07	1.10	1.10	0									
0.17	0.20	-0.03	1.17	1.15	0.02									
0.14	0.10	0.14	1.58	1.60	-0.02									

TABLE 2.31

DIRECT COMPARISON OF INSTRUMENTS USED TO MEASURE CO (Cont.)

	$0 \leq CO < 1$			$1 \leq CO < 2$			$2 \leq CO < 3$			$3 \leq CO < 4$			$4 \leq CO < 5$		
	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v	NDIR %v	HORIBA %v	Δ %v
	0.23	0.30	-0.07	1.51	1.50	0.01									
	0.14	0.12	0.02	1.44	1.40	0.04									
	0.91	1.10	-0.19	1.65	1.75	-0.10									
	0.14	0.10	0.04	1.10	1.00	0.10									
	0.23	0.25	-0.02	1.44	1.40	0.04									
	0.32	0.25	0.07	1.37	1.20	0.17									
	0.12	0.10	0.02	1.65	1.50	0.15									
	0.26	0.10	0.16	1.04	1.15	-0.11									
	0.29	0.28	0.01												
	0.12	0.10	0.02												
	0.17	0.20	-0.03												
	0.17	0.20	-0.03												
	1.04	0.90	0.14												
	0.20	0.15	0.05												
	0.23	0.19	0.04												
	0.17	0.14	0.03												
	0.97	0.77	0.20												
	0.20	0.20	0												
	0.38	0.30	0.08												
	0.14	0.14	0												
	0.91	0.75	0.16												
	0.41	0.42	-0.01												
	0.14	0.13	0.01												
	0.14	0.15	-0.01												
	0.14	0.15	-0.01												
	0.14	0.20	-0.06												
	0.12	0.17	-0.05												
	0.14	0.22	-0.08												
	0.14	0.20	-0.06												
	0.12	0.18	-0.06												
$\overline{X}$	0.349	0.324	0.027	1.438	1.311	0.102	2.486	2.400	0.086	3.541	3.662	- .121	4.208	4.538	-.331
S			0.060			0.22			0.22			0.20			0.33
d.f.			61			39			10			12			11

CO emission at idle and the specification levels. The discrepancy between the floor and keymode measurements was therefore inferred to be in the nature of the test procedure. A detailed investigation was therefore performed to understand the discrepancy.

Records of the floor measurements of CO during the initialization process were not maintained. Rather, reliance was placed on using Idle CO measurements performed in the post-maintenance emissions test series. The reasons for this were: 1) it is the prime measurement used in an actual keymode emission inspection (i.e., with a recently operated vehicle) and 2) the instrument system and test procedures are more closely controlled. Therefore, the discrepancies were originally identified by apparently high post-maintenance Idle CO measurements in the keymode, Table 2.8. Subsequently, all of the pertinent data has been recorded. A comparison of a data set of 32 tests (Fleet 3) showed respective readings of 1.99 percent volume and 2.77 percent volume for the floor meter and keymode Idle CO measurements, respectively. The data clearly indicated that there was a discrepancy between the two measurement approaches. A detailed review of the procedures indicated that there were differences in procedures in the Idle CO measurements by the two methods. For example, during the keymode inspection, all of the Idle CO measurements are made with the transmission in gear, or in the drive position. Conversely, the Chrysler Idle adjustment procedure is performed with the transmission in neutral and the GM procedure requires the vacuum advance to be disconnected and plugged. These differences have been shown not to significantly effect Idle CO; however, it is clear that the two methods are not identical.

The test procedures followed by Scott during emission testing specifies that the Clayton cycles be performed after the 1972 Federal CVS procedure and the Federal Short Cycle. In addition, the mode inspection procedure calls for the operation of the vehicle in seven modes, initiated from an idle mode followed by several intermediate and high cruise modes and, finally, with the 49/45 MPH Cruise mode, 33/30 MPH Cruise mode and the Idle mode. These last three (key) modes are those in which the emission data are reduced. In order to determine if an underhood temperature (i.e., location of the several Idle Mode positions in this test cycle) might be influencing the value of Idle CO, tests were analyzed to determine the difference in the Idle CO emission level between the first and the last idle modes of the keymode testing phase. The results indicated that the average pre-key mode Idle CO was 1.74 percent and the average post-keymode Idle was 2.05 percent. Linear regressions developed with floor measurements as reference indicated that the pre-keymode Idle CO resulted in a slightly higher correlation coefficient (.766) than the post-keymode (.708).

Although this investigation has not clearly resolved the discrepancies between the various Idle CO measurements, it suggests that underhood temperatures and differing manufacturers' repair specifications explain some of the variability. Minor problems in specific cases identified data processing problems and a few cases in which vehicles had highly unstable emissions. For example, in several cases the strip chart tracing had not stabilized over the allocated recording interval. The procedure was therefore changed to allow a longer recording period to obtain a more representative measurement of the stabilized level of the Idle CO emission level. The investigation has, however, clearly indicated that the Idle CO emission level is highly nonrepeatable and is related to the state of the vehicle resulting from the operation previous to the Idle CO measurement. Some investigators have verbally indicated that preconditioning of all cars in a similar manner prior to Idle CO measurements can reduce the variability, but prolonged periods of idle during the measurement may result in an initial period in which Idle CO decreases with time followed by a period in which Idle CO will increase with time. These observations are clearly evidenced by the high degree of scatter in the test data.

2.6.7 Oxides of Nitrogen Measurement Systems

Two analytical instrument systems were used to measure the combined oxides of nitrogen. The program was initiated with NDIR and NDUV instruments to respectively measure NO and NO_2. During the latter part of the vehicle fleet initialization period, the chemiluminescent NO_x measurement system (chemiluminescence instrument) was implemented. With the exception of approximately two weeks of initial operation with only the chemiluminescent instrument on stream, dual instrumentation was used in parallel sampling trains throughout the remainder of the experimental program. Two analyses activities related to this data were performed to characterize this instrumentation. Since the chemiluminescence instruments are the prime NO_x measurement, there was a requirement to develop a relationship for correcting the earlier NDIR/NDUV measurements to an equivalent chemiluminescence basis. Also, since the chemiluminescence instrumentation was newly developed, quality control type monitoring was performed. This section presents:

1) the functional relationships that will be used to adjust NDIR/NDUV measurements of NO_x, 2) a historical presentation of all of the data taken in the first year of testing and 3) a discussion of the potential causes for the observed discrepancies in the two systems.

2.6.7.1 Functional Relationship of Chemiluminescence and NDIR/NDUV NO_x Measurement Systems

The relative precision and accuracy (bias error) of the NO_x measurement systems is presented in Table 2.32. The average chemiluminescence values, together with the average bias, estimate of standard deviation of the bias and the associated degrees of freedom are presented. The data indicate that the chemiluminescence measurements are systematically lower than NDIR/NDUV measurements by approximately 13 percent. Data handling procedures can easily correct data for biases of this type; however, random error as is indicated by the estimate of standard deviation cannot be eliminated by analysis. A random (precision) component of uncertainty of approximately $\frac{19}{\sqrt{2}}$ to $\frac{24}{\sqrt{2}}$ percent or 13 or 17 percent will exist in all adjusted data if it is assumed that the precision of both instrument systems are equal.

Since the chemiluminescent NO instrumentation is specified in the Federal Register, the data taken using dual instrument systems will be used to correct the NO_x data taken during the early part of the test program when only the NDIR/NDUV instruments were used. All of the data taken during the first year of testing following the system start-up period (August 27 to October 20, 1971) were used to develop linear regressions of chemiluminescence measurements with NDIR/NDUV measurements. The data taken during system start-up showed larger discrepancies than the data taken after the final system change and therefore were not included in the regressions. The chemiluminescence data taken during the system start-up period will also be corrected by use of the functions presented in this text. The data used to develop the regressions, together with the linear regression, are presented in Figures 2.50 to 2.54 for each of the following procedures or modes:

1) 1972 Federal CVS
2) Federal Short
3) 49/45 MPH Cruise Mode
4) 33/30 MPH Cruise Mode
5) Idle Mode

The corresponding statistics of the regressions are summarized in Table 2.33.

TABLE 2.32

COMPARISON OF NOX DATA FROM NDIR/UV AND CHEMILUMINESCENCE INSTRUMENTS

	AVERAGE VALUE (NO_XP) g/mile	AVERAGE BIAS (NO_X - NO_XP) %	ESTIMATE OF STANDARD DEVIATION (NO_X - NO_XP) %	DEGREES OF FREEDOM
1972 FEDERAL CVS	3.92	12.6	19	589
FEDERAL SHORT CYCLE	3.16	13.1	24	585

CHEMILUMINESCENCE (NO_XP), NDIR/NDUV (NO_X)

TABLE 2.33

LINEAR RELATIONSHIP OF CHEMILUMINESCENCE AND NDIR/NDUV MEASUREMENTS OF NO_x

$$NO_x \text{ (CHEMILUMINESCENCE)} = a + b \times NO_x \text{ (NDIR/NDUV)}$$

PARAMETER	a	b	STANDARD ERROR OF ESTIMATE	INDEX OF DETERMINATION (R^2)	d.f.
1972 FEDERAL COLD	2.622×10^{-1}	8.636×10^{-1}	3.2×10^{-1}	0.9522	630
FEDERAL SHORT	-1.194×10^{-2}	9.290×10^{-1}	3.1×10^{-1}	0.9478	626
49/45 MPH CRUISE	-1.207×10^{2}	1.012	1.9×10^{2}	0.9585	565
33/30 MPH CRUISE	-1.123×10^{2}	1.010	1.2×10^{2}	0.9772	563
IDLE	-3.107×10^{1}	8.165×10^{-1}	3.3×10^{1}	0.8646	562

FIGURE 2.50

LINEAR REGRESSION OF CHEMILUMINESCENCE AND NDIR/NDUV NOX MEASUREMENTS
1972 Federal CVS Procedure

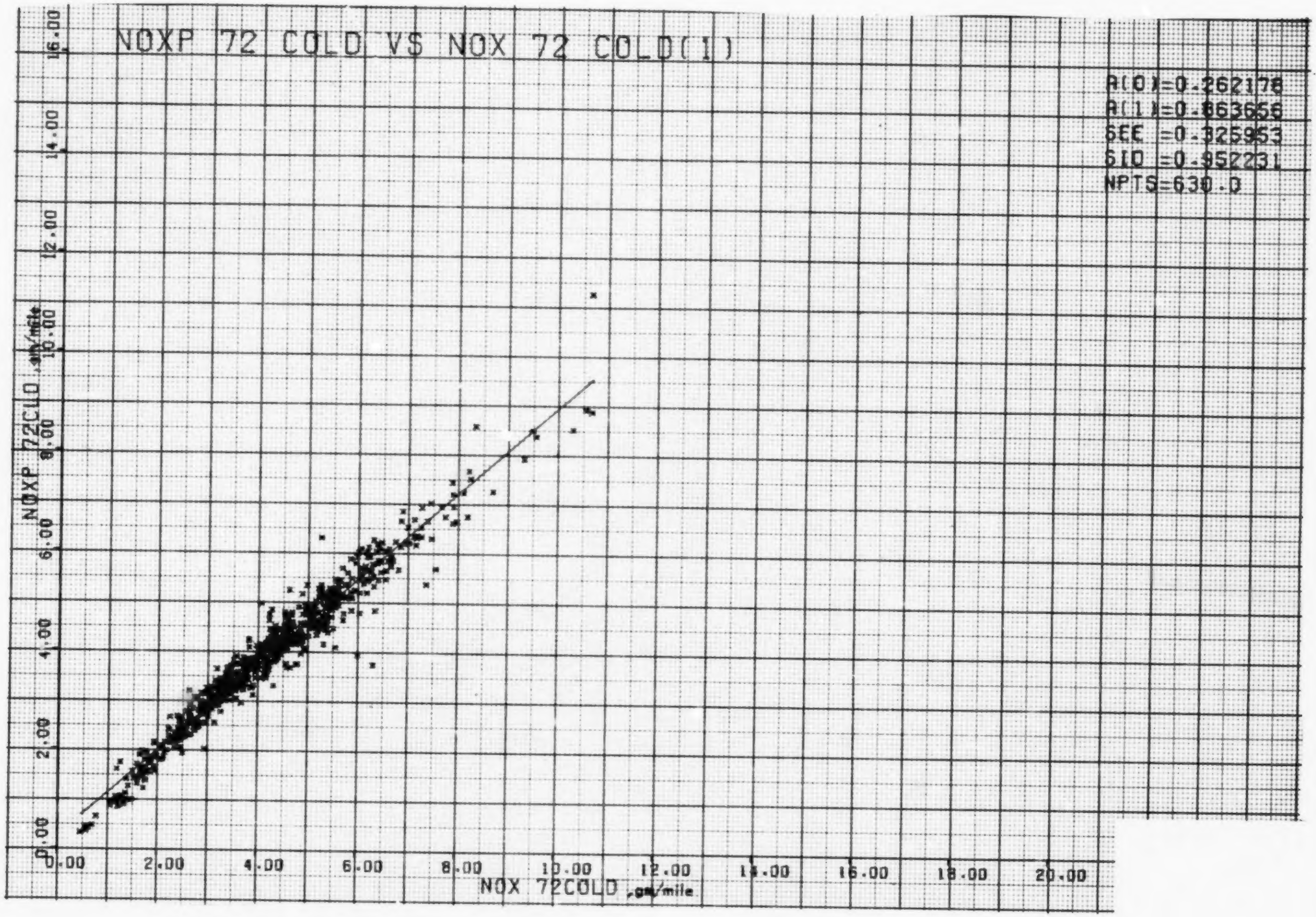


FIGURE 2.51

LINEAR REGRESSION OF CHEMILUMINESCENCE AND NDIR/NDUV NOX MEASUREMENTS
FEDERAL SHORT PROCEDURE

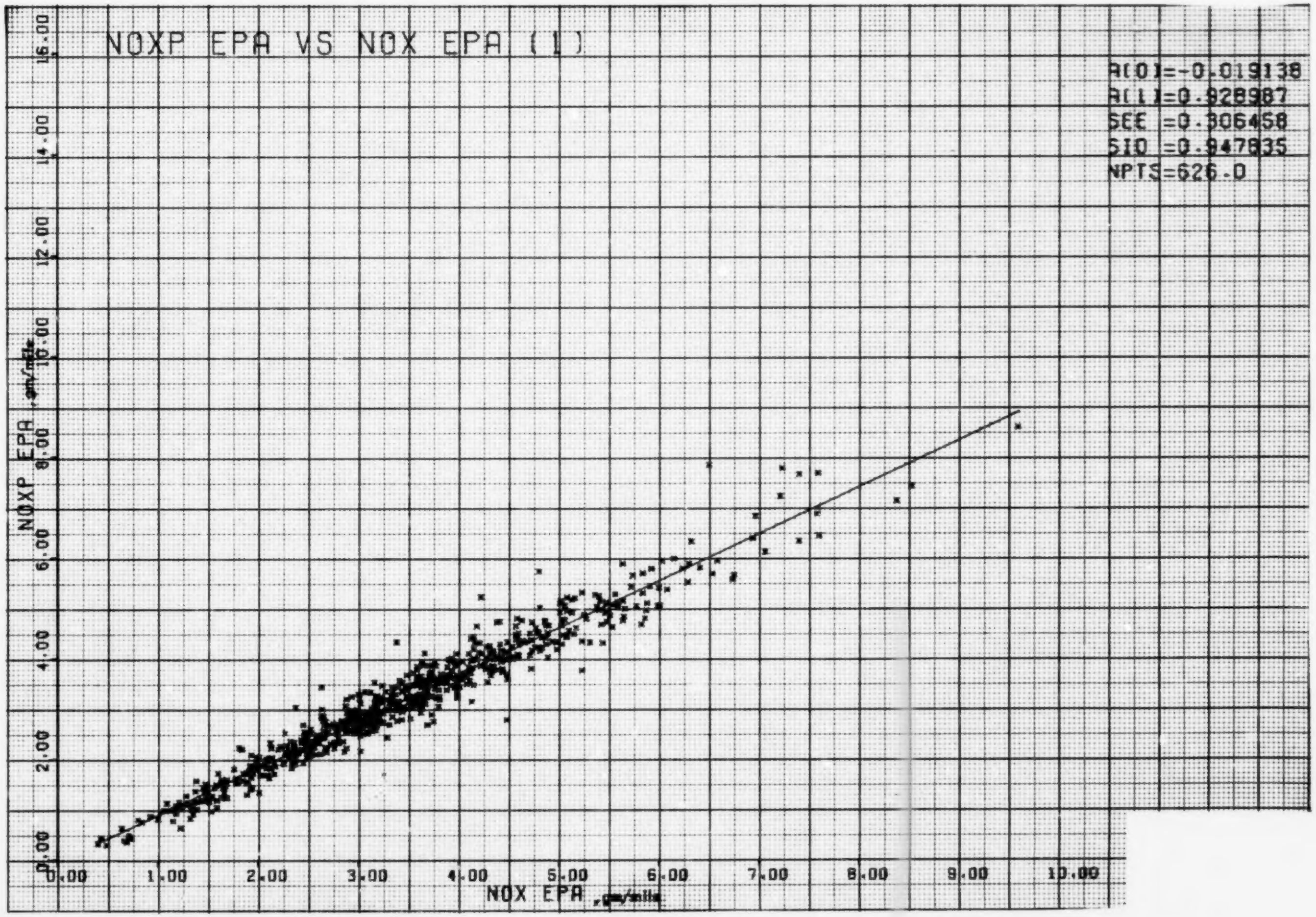


FIGURE 2.52

LINEAR REGRESSION OF CHEMILUMINESCENCE AND NDIR/NDUV NOX MEASUREMENTS
49/45 MPH CRUISE MODE

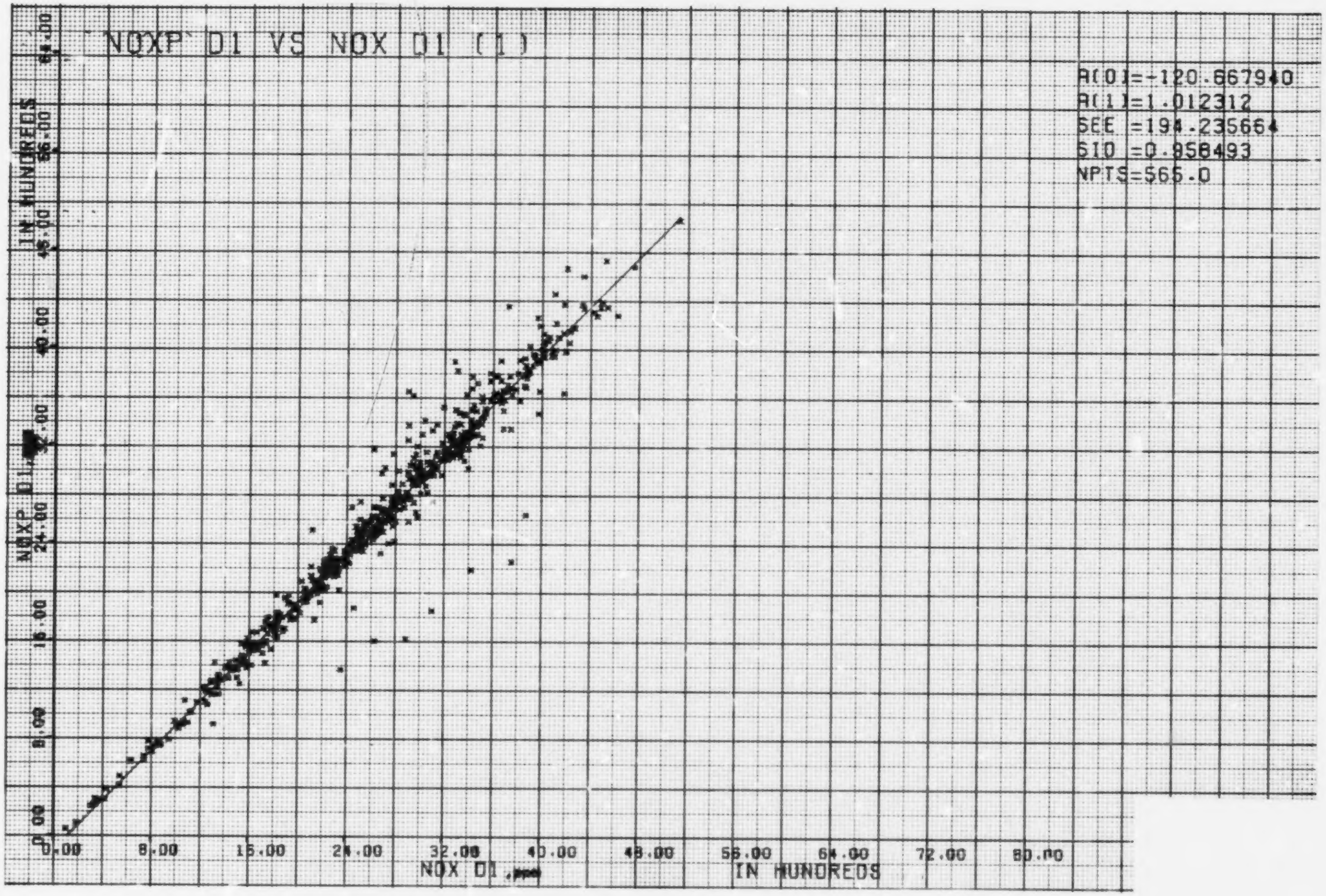


FIGURE 2.53

LINEAR REGRESSION OF CHEMILUMINESCENCE AND NDIR/NDUV NOX MEASUREMENTS
33/30 MPH CRUISE MODE

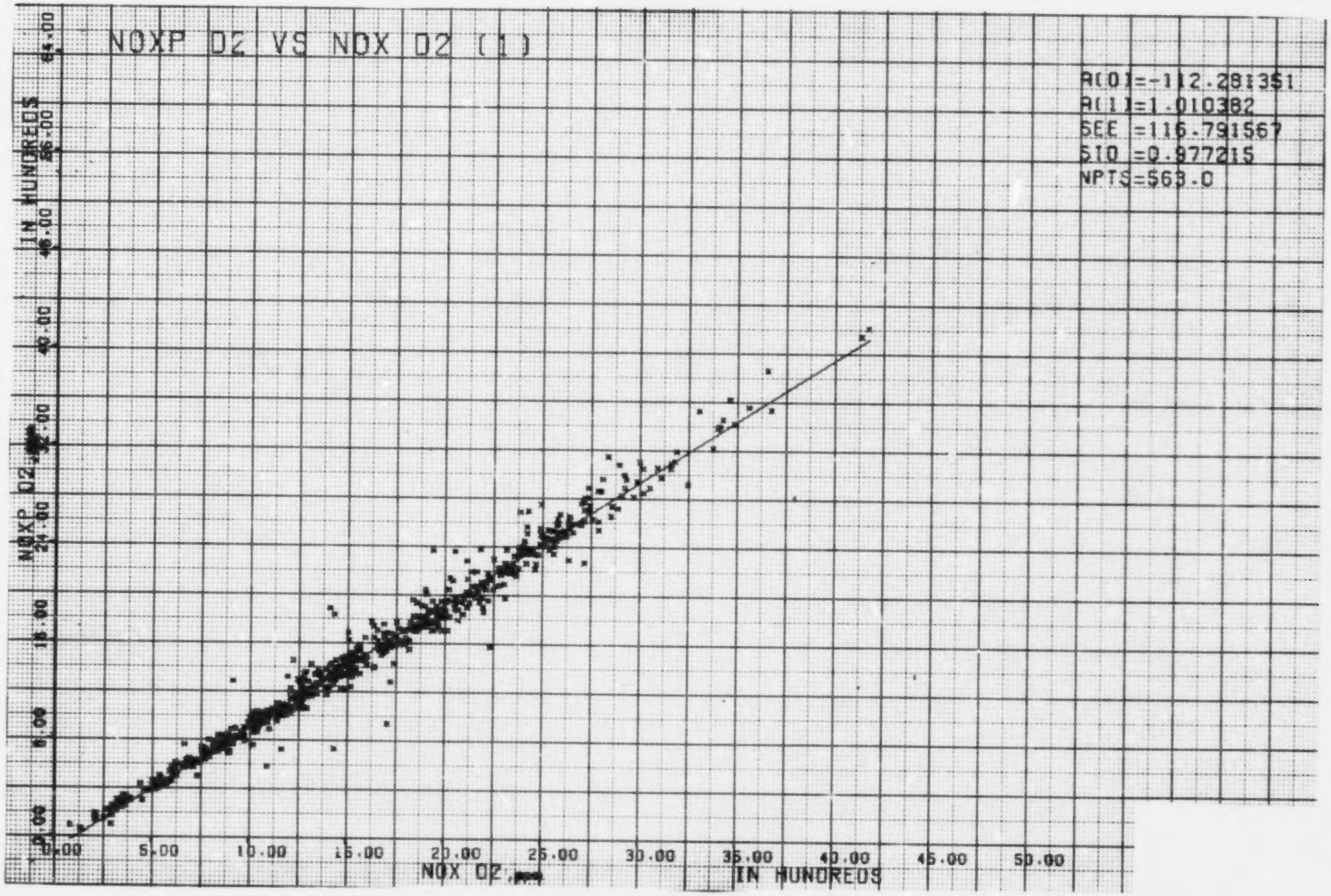
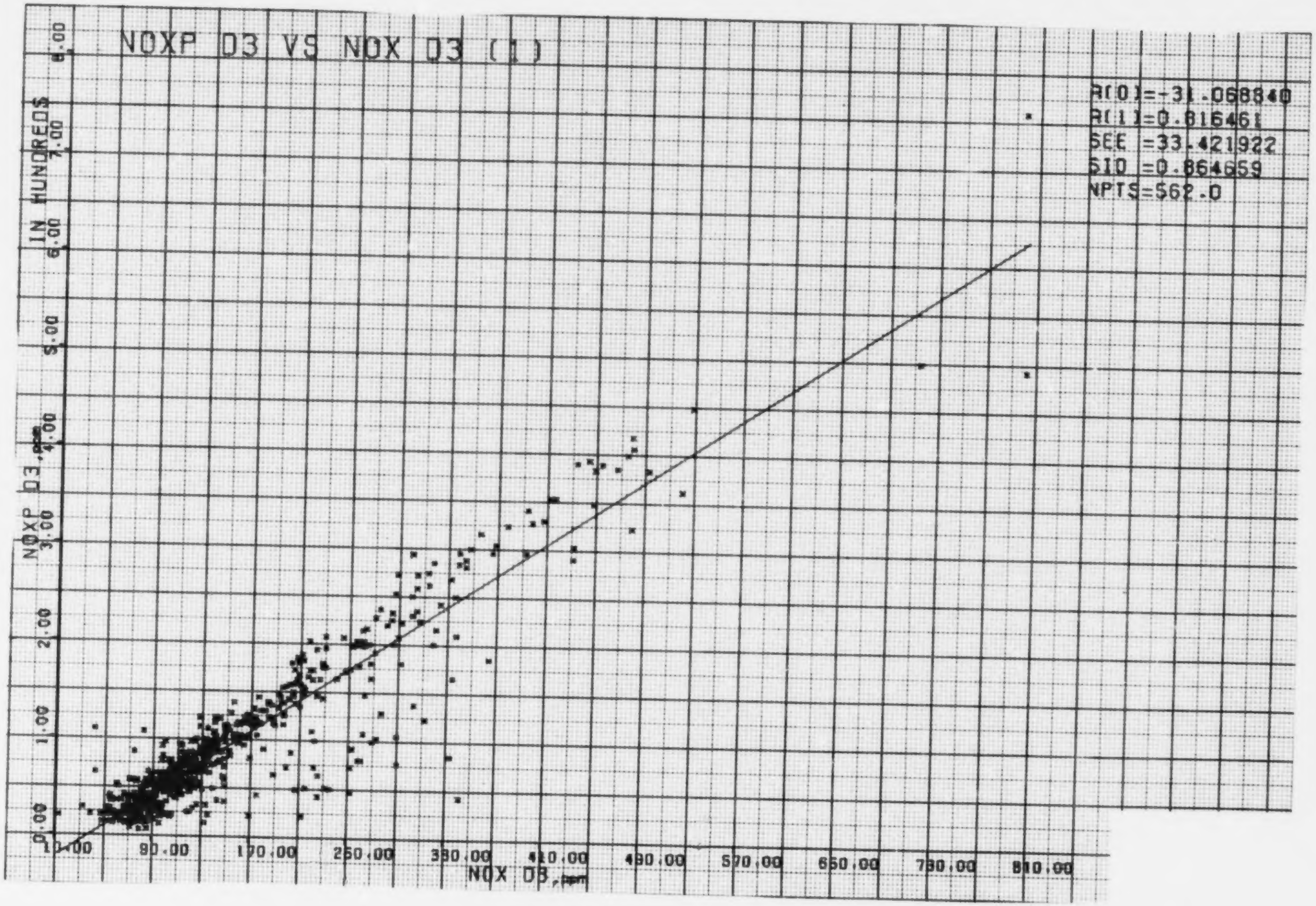


FIGURE 2.54

LINEAR REGRESSION OF CHEMILUMINESCENCE AND NDIR/NDUV NOX MEASUREMENTS
IDLE MODE



The coefficients of the regression analysis, "a" and "b", are indicative of the relative accuracy of the two instrument systems. Values of zero and one, respectively, would indicate perfect correlation. Correlation is seen to significantly improve as the absolute value (gm/mile) of NO_x increases. For example, the measurement made using the 1972 Federal CVS procedure with dilute bag samples ($\sim$100 ppm) has an indicated bias error (b coefficient) of + 14% whereas the direct concentration measurements ($\sim$1000 ppm) in the keymodes have bias errors less than -1%. The idle keymode where NO_x concentrations are of order several hundred ppm (substantially as NO), suggest that the bias is more highly related to absolute value of NO_x than to the presence of NO_2.

2.6.7.2 Historical Review

The chemiluminescence instrument was installed in the analytical instrument systems with the expectation that the system could be implemented with minimum development effort. The early data indicated that the chemiluminescence system measured lower values of NO_x by approximately 21 percent when the 1972 Federal Procedure was used to measure emissions. In addition, the random uncertainty as indicated by the estimate of standard deviation about the mean differences between the two measurement systems was approximately 21 percent. Because of the unexpected large systematic (bias) and random error a considerable amount of data were taken using both instruments. This section presents the analysis made in support of implementing the chemiluminescence system.

In the analysis of discrepancies between two data sets, there is always the initial question as to whether the deviations are constant on an absolute concentration (gm/mile) basis or are constant on a percentage (normalized) basis. An initial plot was therefore made comparing the absolute deviation between the oxides of nitrogen measured using the two systems. The results obtained using the 1972 Federal CVS Procedure and the Federal Short Procedure are presented in Figures 2.55 and 2.56. The data clearly indicate that the deviations are proportional to the measured value. Normalized plots of the ratio of the NDIR/NDUV to chemiluminescence NO_x measurements using the two systems were therefore developed. The results for two test procedures, Figures 2.57 and 2.58, indicate less sensitivity

FIGURE 2.55

VARIATION OF DUAL INSTRUMENT SYSTEM BIAS ERROR WITH ABSOLUTE VALUE OF NOX
FEDERAL SHORT CYCLE

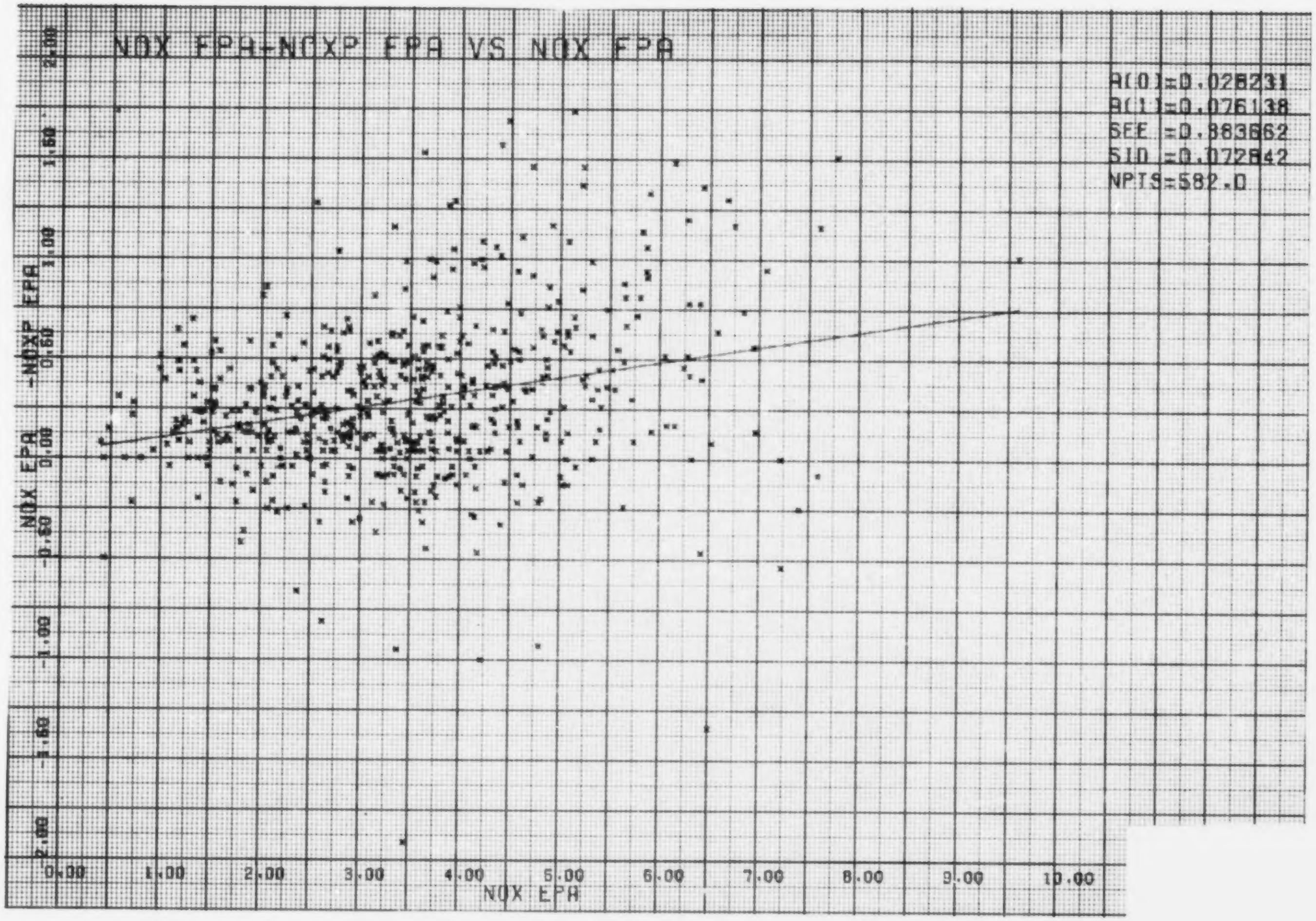


FIGURE 2.56

VARIATION OF DUAL INSTRUMENT SYSTEM BIAS ERROR WITH ABSOLUTE VALUE OF NOX
(1972 FEDERAL CVS PROCEDURE)

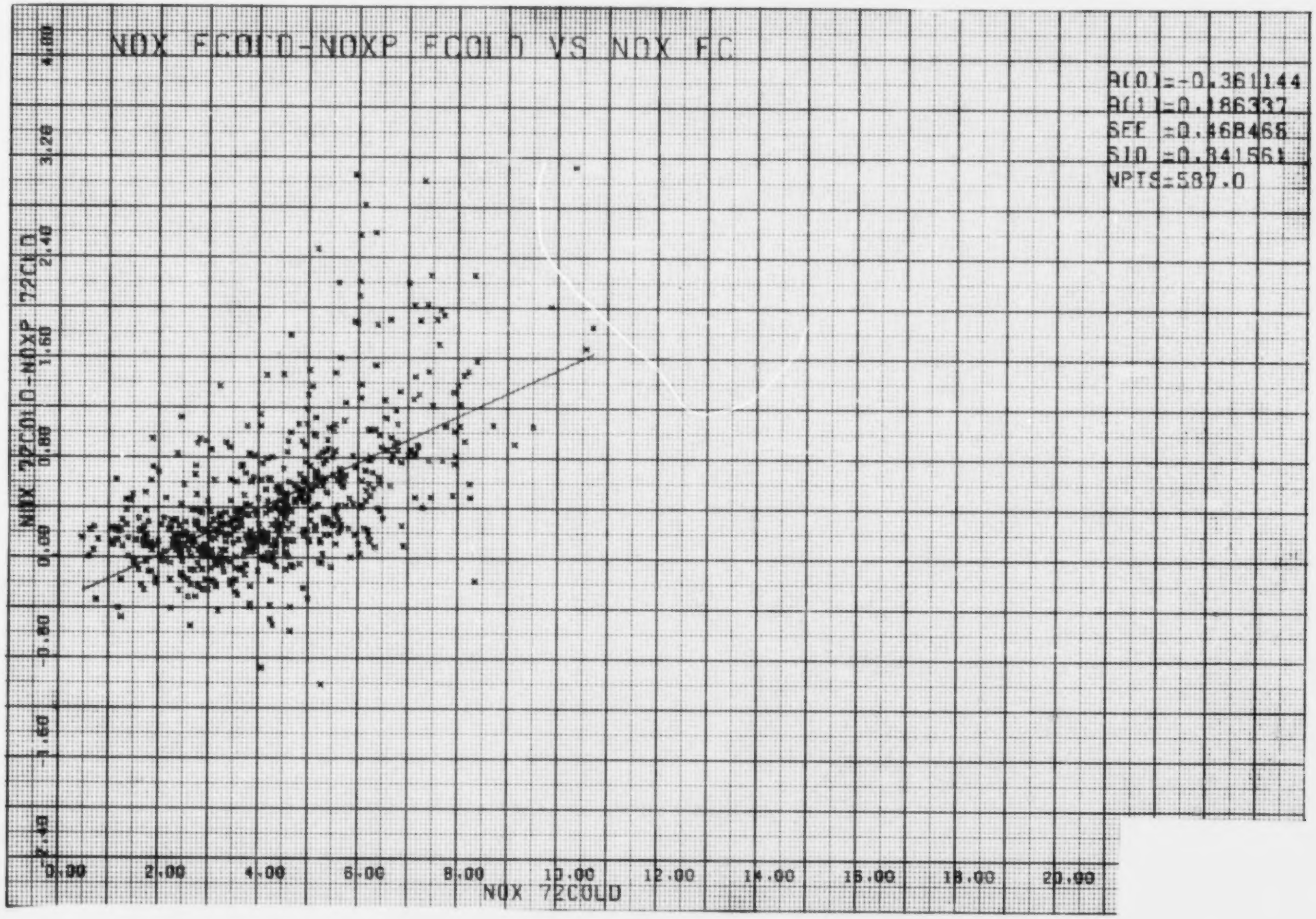


FIGURE 2.57

VARIATION OF NORMALIZED DUAL INSTRUMENT DATA WITH ABSOLUTE VALUE OF NOX
1972 FEDERAL TEST PROCEDURE

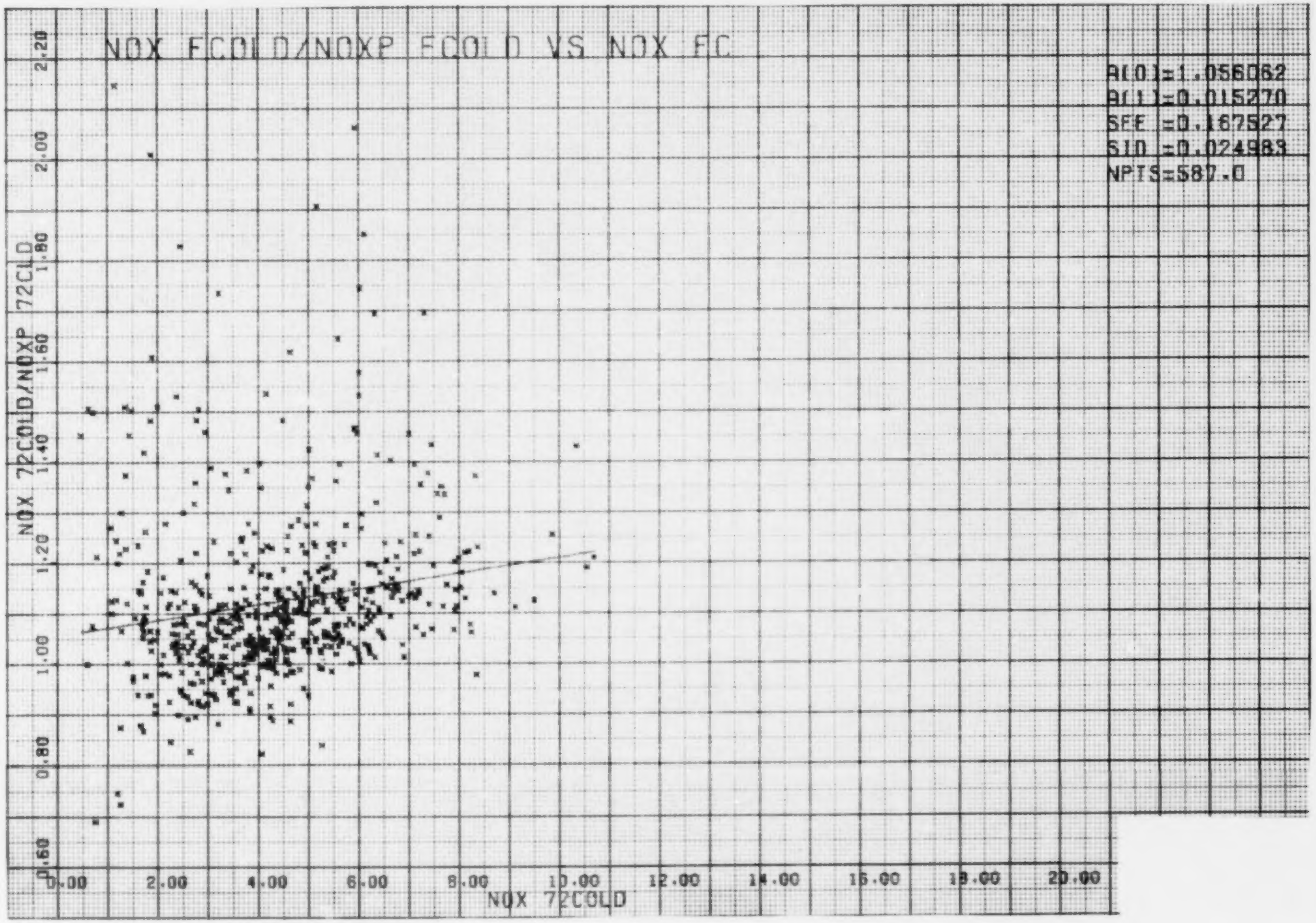
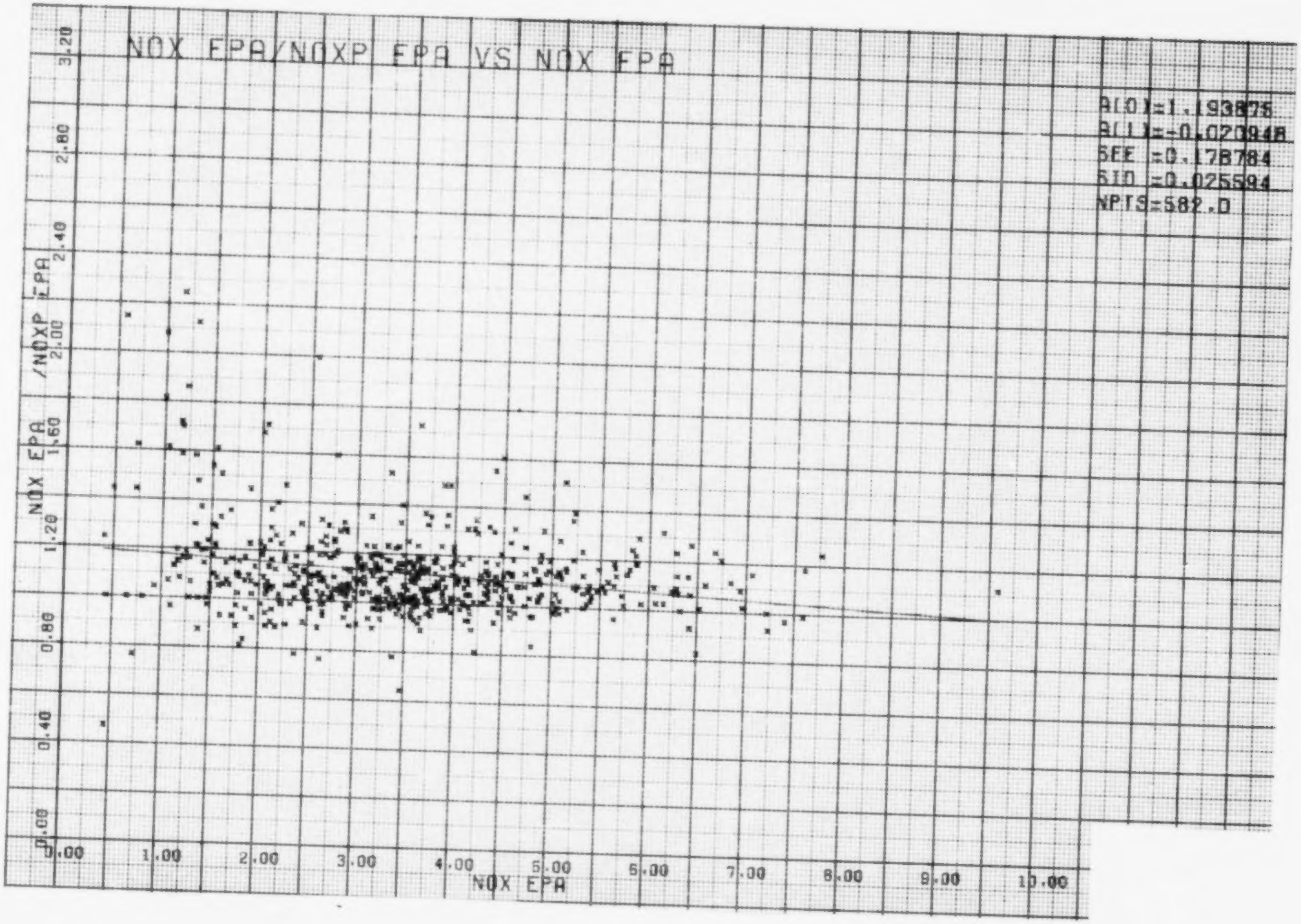


FIGURE 2.58

VARIATION OF NORMALIZED DUAL INSTRUMENT DATA WITH ABSOLUTE VALUE OF NOX
EPA SHORT CYCLE



in the ratio than in the absolute deviations. The normalized 1972 Federal data (Figure 2.59) and Federal Short Cycle Procedure data (Figure 2.60) were relatively invariant with absolute value. Therefore, all subsequent studies are based upon normalized data.

As was indicated in the previous discussion, comparative data using the two instrumentation systems, were taken through a major part of the first year's testing. Scatter diagrams illustrating the functional relationship of normalized NO_x measurements with time (days) are presented in Figures 2.51 and 2.52. The data suggest that changes in NO_x measurements in at least one of the instruments are occurring with time. During the earlier testing, the bias as well as the scatter, were larger than in the remaining periods of the program. During the latter stages of the program, in particular, during the early part of testing in 1972, the bias tends to decrease with time. The data, therefore, were partitioned in accordance to dates in which significant changes in the system or procedures were made. Significant changes were: 1) a change in the sample capillary to improve sample train response made on the 293rd day (Oct. 20, 1971) and 2) on the 390th day (March 3, 1972) the 1975 Federal CVS Procedure was initiated (1972 Federal Procedure equivalent values were computed by merging the transient cold and stabilized hot values). A comparison of the statistics associated with the three data sets, separated by the two changes in the system, is presented in Table 2.34.

Significant statistical differences are indicated. It can be concluded that the data taken in system start-up period contained the largest errors, possibly due to the effect of the sample capillary or other start-up difficulties. The data taken during 1971 tend to stabilize at approximately 6 percent, with a scatter in the data (estimate of standard deviation) of about 12 percent. During the initial period of 1972 in which the procedure for taking the data was changed, the results appeared to again change with an average bias and scatter of respectively 9 percent and 11 percent.

The data taken using the two NO_x instrumentation systems show a high degree of bias and random components of uncertainty although the data does not clearly indicate which of the two instrument systems is at fault. It is clear that the components of uncertainty must be partitioned so that the variability in the measurements can be effectively reduced.

FIGURE 2.59

VARIATION OF NORMALIZED DUAL INSTRUMENTATION DATA WITH TIME
1972 FEDERAL CVS PROCEDURE

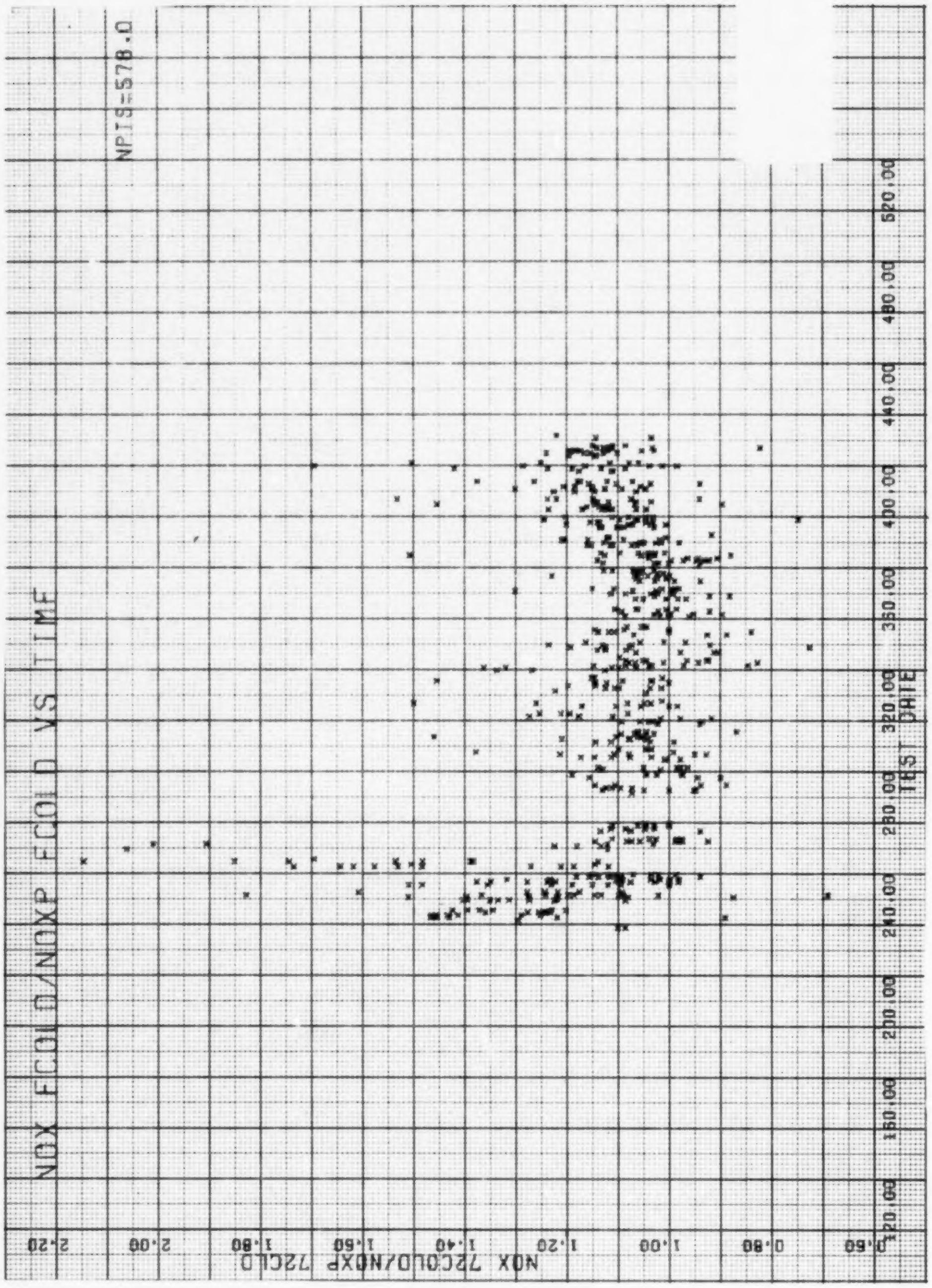


FIGURE 2.60

VARIATION OF NORMALIZED DUAL INSTRUMENTATION DATA WITH TIME
FEDERAL SHORT CYCLE

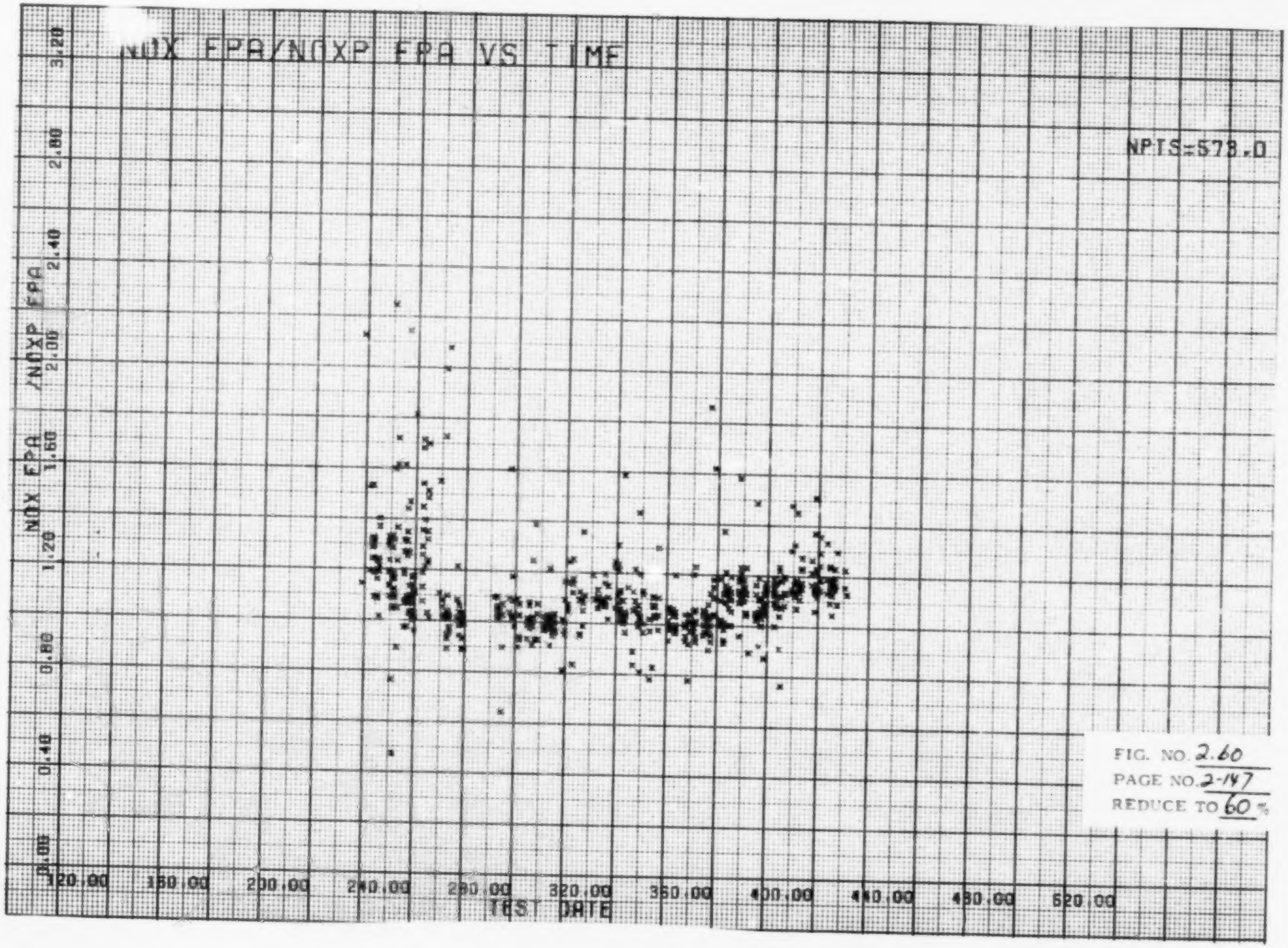


FIG. NO. 2.60
PAGE NO. 2-147
REDUCE TO 60 %

TABLE 2.34

INFLUENCE OF PROCEDURES ON NO_x INSTRUMENT SYSTEM PERFORMANCE

TEST PROCEDURE	FIRST PERIOD START-UP			SECOND PERIOD CAPILLARY CHANGED			THIRD PERIOD 1975 TEST PROCEDURE ADOPTED		
	NO_x/NO_{xp}	S	d.f.	NO_x/NO_{xp}	S	d.f.	NO_x/NO_{xp}	S	d.f.
1972 TEST	1.214	0.21	138	1.066	0.11	194	1.096	0.10	407
EPA SHORT	1.166	0.19	138	1.053	0.13	194	1.128	0.14	407
49/45 CRUISE	1.077	0.11	138	1.060	0.11	194	1.048	0.10	407
POOLED	1.152	0.17	414	1.060	0.12	582	1.091	0.11	1221

NO_x	NDIR/UV Instrument
NO_{xp}	Chemiluminescence Instrument

2.6.7.3 Review of Potential Causes for Discrepancies

During the period of the program in which the verification of the chemiluminescence system was in progress, many reasons for the discrepancies in the two methods for measuring NO_x were hypothesized. Attempts were made to determine if the observed bias and nonrepeatabilities observed in the CAPE-13 tests were significantly different than the results obtained in other test centers throughout the industry, but a clean definition of the state-of-the-art could not be established. Most sources contacted agreed that some discrepancies existed. Informal conversations with industry personnel suggested that some chemiluminescence instrumentation difficulties have been experienced and attributed to variations in conversion temperature, sensor pressure and sample flowrate. Selective dissicant absorption or adsorption (adsorption will be assumed) and stripping of NO_x appeared to be the most prevalent reasons given for anomolies experienced with the NDIR/UV instrument system.

Throughout the remainder of the first year of experimentation and during the initial parts of the second year's testing selective experiments were performed to establish the most accurate method for measuring oxides of nitrogen. Experimental data which will be presented in a separate report published by SRL, has shown that: 1) chemiluminescence measurements are more accurate than NDIR/NDUV measurements and 2) the discrepancies between the two systems are due to dryer system interference of the NO and NO_x concentrations and CO_2 interference of the NDIR instrument.

3.0 ORTHOGONAL EXPERIMENTS

Statistically designed experiments were conducted to relate mass and concentration emission changes to malfunctions and maladjustments. These relationships are fundamental to the development and use of the economic effectiveness model (Reference 9) because they translate maintenance actions, i.e., adjustments in Timing, Idle Speed, Idle CO, etc., to emission reductions. In essence, the experiment is conducted by systematically malfunctioning (per an orthogonally designed test matrix) engine parameters in accordance to a statistically designed procedure and recording the exhaust emissions. The first order emission responses, i.e., changes in emissions with changes in a single engine parameter ($\Delta e_j/\Delta P_i$), two factor interactions, i.e., changes in emission with changes to engine parameters over and above the first order responses, ($\Delta e_j/\Delta P_i \Delta P_k$), and a measure of experimental error may be derived from an analysis of variances. It is hypothesized and later demonstrated that these responses are, to a reasonable approximation, unique to specific classes of engine power trains having similar maintenance states. For example, 1971 Ford 400 CID, V-8 engines with automatic transmissions in vehicles of similar weight will have similar emission response coefficients. The experiments were therefore conducted with small sample sets which in most cases, consisted of a single vehicle which represented a generic power train within the national population.

Eight vehicles were tested to represent the population of vehicles having no exhaust emission control (pre 1966 California vehicles) and eight vehicles were tested to characterize the population of vehicles having controls of the oxides of nitrogen emissions (1971 model year California vehicles). These emission responses were primarily quantified for their effects on hot engine emissions, but a limited amount of subexperiment testing was performed on each vehicle to determine the cold engine emissions responses to several choke related parameters.

3.1 EXPERIMENTAL DESIGN

The experimental design required the definition of the following elements: engine tune-up parameters to be evaluated, selection of a vehicle sample to represent the national population, design of the experiments required for the desired statistical analysis and selection of the test cycles to be used in the experiment. The criteria used for the experimental design and the actual experimental program are presented in the following sections.

3.1.1 Selection of Test Parameters

The selection of the engine tune-up parameters was based on two criteria. These criteria were: 1) that parameters chosen were commonly found to be out-of-specification in actual use and 2) that out-of-specification conditions would cause undesirable increases in exhaust emissions. The information used to make this selection was developed out of the previous year's studies, the Engine Parameter Survey and Orthogonal Screening Experiments (Reference 10). The Engine Parameter Survey characterized the state-of-tune-up of the vehicle population by determining the frequency and extent engine parameters were out-of-specification. The Orthogonal Screening Experiment was similar in concept to the Orthogonal Experiment described herein. The Screening Experiment evaluated the main effects on emission of eleven basic engine tune-up related items. The results obtained from these two previous experiments led to the selection of five engine parameters to be evaluated:

1. Basic Ignition Timing
2. Engine Idle RPM
3. Positive Crankcase Ventilation Valve Restriction
4. Air Cleaner Element Restriction
5. Engine Idle Fuel/Air Mixture (% of Carbon Monoxide)

A sixth parameter was evaluated on the vehicles with controls of oxides of nitrogen. This parameter was the oxides of nitrogen device which controlled vacuum spark advance. This parameter was selected since it represented a major addition to the exhaust control system and was related to engine tune-up, since it has several potential failure modes.

3.1.2 Test Vehicle Selection

The eight vehicles which were tested in each category were selected to best represent in-use vehicles.

The group of Orthogonal Test vehicles used to characterize the population of pre-emission vehicles was representative of the in-use population of 1960-1967 U.S. vehicles exclusive of 1966 and 1967 California vehicles. These vehicles were apportioned to represent the percentage of manufacturer makes currently registered. Only popular driveline options were selected. Table 3.1 describes the original program goals for vehicle selection. The only deviations from this guideline were minor deviations in engine displacements. The pre emission controlled vehicles tested are presented in Table 3.2.

The NO_x group of vehicles were matched to 1971 California mid-year registrations as a percentage of manufacturer makes. The engines and transmissions selected were the more popular sales options. Table 3.3 describes the initial vehicle selection goals. The initial vehicle criteria were modified slightly due to the nature of control hardware and test difficulties which precluded running the desired vehicles on the Orthogonal Tests. The Chevrolet six cylinder vehicle was replaced with a duplicate of the other Chevrolet V-8, automatic transmission vehicle; the American Motors vehicle was equipped with a 250 cubic inch displacement engine instead of 232 cubic inches; the proposed Volkswagen was replaced with a Toyota, four cylinder, manual transmission vehicle. All of the 1971 vehicles had a minimum of 3000 odometer miles. A description of the vehicles that were ultimately tested is presented in Table 3.4.

The emission test cycles and procedures used in the experiment were selected to evaluate driving and diagnostic cycles currently in use or under consideration. The main Orthogonal Tests employed the 1972 Federal Test Procedure, the closed 7-mode CVS test procedure, the Federal Short Cycle CVS test and short cycle procedures (the Clayton Keymode Cycle) on a direct exhaust concentration basis. All of these cycles were performed with a thermally stabilized engine. The Cold Start tests of the choke parameter effects were conducted using the 1972 Federal Test Procedure. The description of the specific test procedure is presented in Section 3.2--Test Procedures.

TABLE 3.1

ORTHOGONAL TEST
PROPOSED PRE-EMISSION CONTROLLED VEHICLES

Vehicle Make	Estimated % of 1960-67 Population	Engine Displacement	Engine Type	Transmission
Chevrolet	26.6%	283/327	V-8	Automatic
Chevrolet		194/230	6	Manual
Ford/Mercury	26.2%	289	V-8	Automatic
Ford/Mercury		170/200	6	Manual
Dodge/Plymouth	13.0%	273/318	V-8	Automatic
Dodge/Plymouth		225	6	Manual or Automatic
Pontiac	8.3%	389	V-8	Automatic
Oldsmobile	6.4%	394/425	V-8	Automatic

Notes:
1. V-8 engines comprise 67% of the in-use population.
2. Automatic transmissions comprise 79.5% of the population. (Only two manual transmissions equipped vehicles are to be tested.)

TABLE 3.2

DESCRIPTION OF PRE-EMISSION CONTROL VEHICLES TESTED IN THE ORTHOGONAL EXPERIMENT

VEHICLE NO.	MAKE	MODEL	YEAR	ENGINE DISP. Cu. In.	CYLINDERS	CARB. BBLS.	TRANS. TYPE
701	CHEVROLET	MALIBU	1967	283	8	2	AUTO
702	FORD	GALAXIE	1964	289	8	2	AUTO
703	DODGE	DART	1965	273	8	2	AUTO
704	CHEVROLET	NOVA	1965	194	6	1	MANUAL
705	DODGE	DART	1963	225	6	1	AUTO
706	FORD	FALCON	1961	144	6	1	MANUAL
707	PONTIAC	BONNEVILLE	1963	389	8	4	AUTO
708	OLDSMOBILE	88	1959	371	8	2	AUTO

TABLE 3.3

ORTHOGONAL TEST
PROSPECT NO_X(1971) CONTROLLED VEHICLE FLEET

Vehicle Make	Estimated % of Population	Engine Displacement	Engine Type	Transmission
Chevrolet	23%	350	V-8	Automatic
Chevrolet		250	6	Manual
Ford/Mercury	30%	351	V-8	Automatic
Ford/Mercury		400 or 429	V-8	Automatic
Chrysler	19%	318	V-8	Automatic
Oldsmobile/Pontiac	7%/7%	455/400 or 455	V-8	Automatic
American Motors	5%	232	6	Automatic
Volkswagen	6%(E)	96.7	4	Manual

Notes: 1. Only 1969 model year data is available for transmission and engine type as a percent of registration.

2. V-8s comprise 77.3% of the population and 89.8% of U.S. installations.

3. Automatics comprise 92.5% of U.S. installations.

TABLE 3.4

DESCRIPTION OF NOX-CONTROLLED VEHICLES TESTED IN THE ORTHOGONAL EXPERIMENT

VEHICLE NO.	MAKE	MODEL	YEAR	ENGINE DISP. Cu. In.	CYLINDERS	CARB. BBLS.	TRANS. TYPE
801	DODGE	CHARGER	1971	318	8	2	AUTO
802	CHEVROLET	NOVA	1971	350	8	2	AUTO
803	MERCURY	COLONY PARK STATION WAGON	1971	429	8	4	AUTO
804	RAMBLER	HORNET	1971	258	6	1	AUTO
805	FORD	GALAXIE	1971	351	8	2	AUTO
806	CHEVROLET	MALIBU	1971	350	8	2	AUTO
807	PONTIAC	GRAND PRIX	1971	400	8	4	AUTO
808	TOYOTA	CORONA MK II	1971	113	4	2	MANUAL
809	CHEVROLET	MONTE CARLO	1971	350	8	2	AUTO

3.1.3 Orthogonal Experimental Design

The Orthogonal Experimental Test Program consisted of systematically selectively malfunctioning engine parameters and emissions testing pre-emission controlled and NO_x controlled California vehicles. In order to cost effectively develop the influences of parameter malfunctions on emissions, fractional factorial experimental designs were selected. This section describes the rationale for the specific designs used to develop emission response coefficients, including two factor interactions.

3.1.3.1 Design for Pre-Emission Controlled California Vehicles

The orthogonal testing of pre-emission controlled California vehicles was performed in a manner identical to the experiments previously conducted with emission controlled California vehicles (600 Series testing presented in Reference 10). The investigation consisted of evaluating the effects of five engine parameters, timing, idle rpm, PCV valve, air cleaner and idle CO. Two levels of these five variables were selected with the exception of idle CO, which was varied at three levels. The shorthand notation for this experiment is $2^4 3$, variables (levels), and would require 48 tests to develop the response coefficients if a total factorial experiment were performed, i.e., each parameter was separately investigated. Since the costs for conducting 48 tests with each vehicle would be excessive, a one-half replicate of the $2^4 3$ experiment was proposed. The reduction in the number of tests, however, resulted in six cases of experimental confounding. The experimental design together with the malfunction settings and the resulting cases of confounding is presented in Table 3.5.

3.1.3.2 Design for NO_x Controlled California Vehicles

Several experimental designs were used in the testing of NO_x controlled vehicles in California. The first design was a one-quarter replicate of a $2^5 x3$ factorial experiment. The design and the associated malfunction settings for this experiment are described in Table 3.6. Following the testing of one vehicle with this design, the design was abandoned because it was concluded that the main effects could not satisfactorily be separated from the two factor interactions. The degree of

TABLE 3.5
MALFUNCTION SETTINGS FOR PRE-EMISSION CONTROL VEHICLES

DESIGN FOR A ONE-HALF REPLICATE OF A 2^4x3 FACTORIAL DESIGN

	A	B	C	D	E
RUN	TIMING (degrees off nominal)	IDLE RPM (% Deviation from nominal)	PCV VALVE	AIR CLEANER (% CO)	IDLE CO (% Deviation from nominal)
B*					
1	10	10	Open	0.5	0
2	10	-20	Open	0	2.0
3	10	-20	Closed	0.5	-0.5
4	- 7	10	Open	0	-0.5
5	- 7	10	Open	0	0
6	10	-20	Closed	0.5	2.0
7	- 7	-20	Open	0.5	2.0
8	10	10	Open	0.5	2.0
C*					
9	10	-20	Open	0	-0.5
10	- 7	-20	Closed	0	0
11	10	-20	Closed	0.5	0
12	10	10	Closed	0	2.0
13	- 7	-20	Closed	0	2.0
14	- 7	-20	Closed	0	-0.5
15	10	10	Closed	0	-0.5
16	10	10	Open	0.5	-0.5
D*					
17	- 7	-20	Open	0.5	0
18	10	10	Closed	0	0
19	- 7	10	Open	0	2.0
20	- 7	10	Closed	0.5	-0.5
21	- 7	10	Closed	0.5	2.0
22	- 7	-20	Open	0.5	-0.5
23	- 7	10	Closed	0.5	0
24	10	-20	Open	0	0
E*					

Experimental Confounding
AB=CD AC=BD AD=BC

*Vehicle stability tests set at manufacturer's specifications.

TABLE 3.6

MALFUNCTION SETTINGS FOR NO$_X$ CONTROLLED VEHICLES

DESIGN FOR A ONE-QUARTER REPLICATE OF 2^5x3 FACTORIAL EXPERIMENT

RUN	A TIMING (DEGREES)	B IDLE RPM (%)	C PCV VALVE	D AIR CLEANER	E IDLE CO (%)	F NO$_X$ CONTROL
B*						
1	-10	-20	Open	Restricted	+2.0	Failed
2	-10	+10	Open	Open	+0.5	Failed
3	+ 7	-20	Closed	Restricted	+0.5	Failed
4	-10	-20	Closed	Open	-0.5	Operational
5	+ 7	+10	Open	Restricted	-0.5	Operational
6	+ 7	+10	Closed	Open	-0.5	Failed
7	-10	+10	Open	Open	-0.5	Failed
8	+ 7	-20	Open	Open	+2.0	Operational
C*						
9	+ 7	+10	Closed	Open	+0.5	Failed
10	+ 7	+10	Open	Restricted	+0.5	Operational
11	+ 7	-20	Closed	Restricted	-0.5	Failed
12	-10	+10	Open	Open	+2.0	Failed
13	-10	-20	Closed	Open	+0.5	Operational
14	+ 7	+10	Closed	Open	+2.0	Failed
15	-10	-20	Closed	Open	+2.0	Operational
16	-10	+10	Closed	Restricted	+2.0	Operational
D*						
17	-10	-20	Open	Restricted	-0.5	Failed
18	+ 7	+10	Open	Restricted	+2.0	Operational
19	+ 7	-20	Open	Open	-0.5	Operational
20	-10	+10	Closed	Restricted	-0.5	Operational
21	-10	+10	Closed	Restricted	+0.5	Operational
22	-10	-20	Open	Restricted	+0.5	Failed
23	+ 7	-20	Closed	Restricted	+2.0	Failed
24	+ 7	-20	Open	Open	+0.5	Operational
E*						

*Vehicle stability tests set at manufacturer's specifications.

Experimental Confounding

A = BE D = CE AD = BC
B = AE E = AB = CD
C = DE AC = BD

confounding that resulted with this experiment is summarized in Table 3.6. There are six cases in which confounding of main and two-factor interactions resulted. An alternative design was therefore developed.

A one-half replicate of a 2^6 factorial experiment was therefore selected. This design allows for the clear determination of all main and two-factor interactions. Two levels of idle CO for the NO_x controlled 1971 vehicles were selected because in comparison with older vehicles, pre-emission or emission controlled vehicles, the idle adjustment range is limited by design. The experimental design, together with the malfunction settings that were used in the experiments, is presented in Table 3.7. This design resulted in no confounding of main or two-factor interactions. The number of tests, however, was increased from the 24 that were originally planned to 32.

1971 Ford vehicles sold in California did not have NO_x control devices. Therefore, in the testing of 1971 Ford vehicles, only a five parameter experiment was performed using a one-half replicate of a 2^5 factorial experiment. This design required 16 tests and resulted in no confounding of main or two-factor interactions. The experimental design and the associated malfunction settings used in these tests are presented in Table 3.8.

3.1.4 Data Reduction Procedure

The data reduction procedure utilized in this experiment is described in detail in Section 2.5 of this report.

3.1.5 Data Analysis Procedure

The statistical designs used in the experiments (Section 3.1.3) dictated the type of analysis that was to be performed. The analysis procedure consisted of applying fractional factorial analysis of variance routines to the associated data. Data editing and consistency checks were made previous to this analysis. The analyses procedures, together with the computer programs used to analyze the data, are described in Section 2.5.

TABLE 3.7

MALFUNCTION SETTINGS FOR NO_X CONTROLLED VEHICLES

DESIGN FOR A ONE-HALF REPLICATE OF 2^6 FACTORIAL EXPERIMENT

RUN	A TIMING (DEGREES)	B IDLE RPM (%)	C PCV VALVE	D AIR CLEANER	E IDLE CO (%)	F NO_X CONTROL
B*						
1	-10	+10	Closed	Open	-0.5	Failed
2	+ 7	+10	Closed	Restricted	2.0	Operational
3	-10	+10	Open	Open	2.0	Failed
4	+ 7	-20	Closed	Restricted	2.0	Failed
5	+ 7	+10	Closed	Open	-0.5	Operational
6	+ 7	+10	Closed	Open	2.0	Failed
7	+ 7	+10	Closed	Restricted	-0.5	Failed
8	-10	+10	Closed	Restricted	2.0	Failed
9	-10	+10	Open	Open	-0.5	Operational
10	-10	-20	Open	Open	-0.5	Failed
11	+ 7	-20	Open	Restricted	-0.5	Failed
C*						
12	-10	+10	Closed	Open	2.0	Operational
13	+ 7	-20	Open	Open	-0.5	Operational
14	-10	+10	Open	Restricted	-0.5	Failed
15	-10	-20	Closed	Restricted	2.0	Operational
16	+ 7	+10	Open	Restricted	2.0	Failed
17	-10	-20	Closed	Open	2.0	Failed
18	+ 7	-20	Open	Restricted	2.0	Operational
19	+ 7	-20	Open	Open	2.0	Failed
20	+ 7	+10	Open	Restricted	-0.5	Operational
21	+ 7	-20	Closed	Open	2.0	Operational
22	-10	-20	Open	Restricted	-0.5	Operational
D*						
23	-10	-20	Closed	Restricted	-0.5	Failed
24	-10	-20	Open	Restricted	2.0	Failed
25	+ 7	-20	Closed	Restricted	-0.5	Operational
26	+ 7	-20	Closed	Open	-0.5	Failed
27	-10	+10	Closed	Restricted	-0.5	Operational
28	-10	-20	Open	Open	2.0	Operational
29	-10	-20	Closed	Open	-0.5	Operational
30	+ 7	+10	Open	Open	-0.5	Failed
31	+ 7	+10	Open	Open	2.0	Operational
32	-10	+10	Open	Restricted	2.0	Operational
E*						

*Vehicle stability tests set at manufacturer's specifications.

Experimental Confounding

No confounding of main or two-factor interactions.

TABLE 3.8

MALFUNCTION SETTINGS FOR FORD VEHICLES

DESIGN FOR A ONE HALF REPLICATE OF 2^5 FACTORIAL EXPERIMENT

	A	B	C	D	E
RUN	TIMING (DEGREES)	PCV VALVE	IDLE RPM (%)	AIR CLEANER	IDLE CO (%)
B*					
1	-10	Closed	+10	Open	2.0
2	+ 7	Closed	-20	Restricted	-0.5
3	-10	Open	+10	Restricted	2.0
4	+ 7	Open	+10	Restricted	-0.5
5	-10	Open	+10	Open	-0.5
6	+ 7	Open	-20	Open	-0.5
7	-10	Open	-20	Open	2.0
8	+ 7	Open	-20	Restricted	2.0
C*					
9	+ 7	Closed	+10	Open	2.0
10	-10	Closed	+10	Open	-0.5
11	+ 7	Closed	-20	Restricted	2.0
12	+ 7	Open	-20	Open	2.0
13	+ 7	Closed	-20	Open	-0.5
14	-10	Closed	-20	Restricted	-0.5
15	-10	Open	+10	Restricted	-0.5
16	-10	Closed	+10	Restricted	2.0
D*					

*Vehicle stability tests set at manufacturer's specifications.

3.2 TEST PROCEDURES

3.2.1 Vehicle Preparation

All of the test vehicles were thoroughly inspected and maintained in order to obtain a nominal operating condition based on the age of the population being represented. It was required that major driveline components such as cylinder compression, blowby, transmission operation, and brake performance be in good condition to insure experimental results representative of only the tune-up parameters. Thus, the results would not be confounded by the effects of poor driveline condition. This approach also protected against costly breakdowns during the test program.

Consideration was given to the age of the population being tested, i.e., the 1971 vehicles were expected to have compression pressures that were nearly equal across cylinders and close to specifications whereas the 1960-67 vehicles were expected to have compression pressures that were lower than specifications and varying between cylinders. However, on older vehicles, very low individual cylinder compression readings were either corrected or the vehicle was rejected.

Before emissions testing, leaking exhaust systems were repaired, rear tires inflated to 45 psi and crankcase oil and filter changed. Before proceeding with any engine maintenance, the "as-received" emission tests were performed.

The engine and tune-up condition were then thoroughly diagnosed and maintained to manufacturers' specifications wherever appropriate. Original manufacturers' equipment was used for replacement parts. Table 3.9 summarizes all of the inspection items and resulting maintenance procedures that were performed. In no case were the exhaust emissions optimized by adjusting engine parameters to anything other than the manufacturers' normal service specifications. These specifications also served as the null settings for the Orthogonal Experiment Parameters. The idle mixture (% CO) was set to the specifications given in Table 2.3 of Section 2.2.3 of the Fleet Parameter Deterioration Experiment.

TABLE 3.9

ORTHOGONAL TEST INSPECTION AND TUNE-UP PROCEDURES

Inspection Items	Maintenance Requirements
1. Engine parameter inspection (ref. Section 2.2.1 Fleet Parameter Deterioration Study)	1. Replace spark plugs, ignition points and condenser, PCV valve, air cleaner element and heat riser valve. Replace when required, ignition wires, distributor cap and rotor. Adjust timing, idle rpm and mixture.
2. Check intake and exhaust manifold and carburetor flange fastner torque	2. Tighten to specification
3. Obtain cylinder cranking compression	3. Perform valve job if required
4. Inspect all carburetor and choke adjustments	4. Rebuilt or replace carburetors where necessary. Set all adjustments to specifications.
5. Inspect distributor advance mechanisms and wear characteristics	5. Replace distributor if wear is excessive or advance curves do not meet specifications
6. Check transmission linkage	6. Adjust to specification
7. Inspect other components	7. Maintain cooling systems, repair vacuum leaks, repair PCV system hoses.

3.2.2 Exhaust Emission and Test Cycles

Each of the vehicles used in the Orthogonal Experiments was tested in four experimental sequences. Each vehicle was tested before and after the initial preparation and tune-up. Three different experiments were then performed; the main orthogonal, the cold engine parameter, and the vehicle stability. The Orthogonal Tests provided the data required to determine the change in exhaust emissions due to changes in the selected engine parameters. The cold engine parameter experiments provided a relationship between cold start emissions and malfunctions of exhaust heat riser valve or improper settings in the choke vacuum kick or bimetal spring index. The vehicle stability tests, which were performed at regular intervals during the Orthogonal Experiments, provided data indicating the stability of the vehicles' emissions over time and accumulated mileage.

Except for the cold engine parameter test series, each test in the above experiments consisted of setting the engine parameters as required and performing the following emission test sequence from a hot start:

1. 1972 Federal Test Procedure--Constant Volume Sample Mass Emissions
2. Two 7-Mode Cycles (1968-71 Federal Test Procedure)--Closed Cycle Constant Volume Sample Mass Emissions
3. Federal Short Cycle--Two minute Constant Volume Sample Mass Emissions
4. Diagnostic Cycles--Short driving cycle direct concentration emissions.

All of the choke tests and the before and after tune-up tests were from a cold start using the 1972 Federal Test Procedure. The Federal Short and Diagnostic Cycles are described in Figures 2.9 and 2.10, respectively.

The performance of the Orthogonal Experiments, cold engine parameter tests and stability tests required that the vehicle tune-up parameters be adjusted to desired settings before conducting each emission test sequence. The parameter setting deviations from specifications selected for each experiment are listed in matrix form in Section 3.1, Experimental Design Section. Table 3.8, Orthogonal Test Matrix for 1971 California vehicles without NO_x devices, was required for the Ford Motor Company vehicles as they were not equipped with spark retard controls.

3.2.3 Experimental Procedures and Controls

As noted previously, each experimental run required that the engine parameters be set to predetermined values. These parameters were carefully set and confirmed before each emission test sequence. The sequence used to set up every vehicle was always identical to avoid procedural errors. The basic timing was set first, followed by the PCV valve and air cleaner element settings. The NO_x control device was then set to specification on those vehicles so equipped, and finally the idle rpm and percent CO were set to the desired specifications. This procedure avoided an interaction process while converging on the desired specifications. For example, the idle percent CO is affected not only by the carburetor mixture adjustment, but also by the restriction of the PCV system, rpm and timing. Thus, if the desired idle percent CO was set first, the actual value during the test would be different after the other parameters were set.

The settings of idle rpm, timing and idle percent CO were made with conventional engine adjustments and procedures. The other parameters required simulated failures which could be precisely repeated during the various experimental runs (i.e., introduce no random error). The PCV valve was tested at two levels--normally operating at the nominal level and fully restricted. This was accomplished by installing a valve in the PCV hose between the PCV valve and the carburetor. The valve was set in the fully closed and fully opened position as required. The settings for air cleaner element were nominal (new element) and restricted. The air cleaner element restriction was simulated by putting heavy tape on the outside of the filter element. Five vertical openings were equally spaced around the circumference in order that any affect on mixture distribution would be avoided. The total amount of the opening was adjusted in order to obtain the desired degree of restriction of the filter element. The desired restriction was one which produced an 0.5 percent CO change in the exhaust at 50 mph road load relative to a new element. An upper limit of the amount restriction was maintained if the CO emissions did not respond to the restriction. The upper limit of the restriction was a full scale reading (180°) on an AC Model 0 air cleaner tester. The settings for the NO_x control device were normally operating and completely failed. The failure mode for the spark retard NO_x devices was to provide full carburetor vacuum to the distributor vacuum advance mechanism, thus effectively bypassing the solenoid control valve. This failure mode was selected since it would be the most detrimental to emissions if it were to actually occur and because it was determined to be one of the more probable failure modes in actual service.

The desired idle percent CO settings were not always achievable because of its effect in combinations with other malfunctions on driveability or because of adjustment limiters. The combinations of other settings often interfere with making lean and rich mixture settings. Thus, the limits of percent CO were determined by the actual ability to make these settings, under the various test conditions. However, after establishing limits, the same mixture deviations were set on every test.

As idle CO settings are not generally stable to the degree desired for this type of an experiment, special procedures were used to control this setting. The coolant temperature out of the engine block was used as a control point on all vehicles and the carburetor fuel bowl temperature was monitored on the 1971 vehicles. The vehicle was driven on the dynamometer until the temperatures had stabilized at the desired value before setting the idle mixture. Also prolonged idling was avoided while making the mixture setting. The temperatures were reestablished until the desired CO setting had been obtained. After the completion of all of the emission test cycles for each run, the idle CO was rechecked to determine if it had been held constant. Post run variations of greater than about 0.3 percent CO from the desired setting required that the vehicle be reset and retested on that run.

Other test controls were used to insure reliability of the emission readings and to prevent unwanted variances in the 1971 vehicles. The fuel tank vent line was disconnected from vehicles equipped with evaporative emission storage containers. To prevent unwanted deposit accumulation during the test series a low lead concentration Indolene fuel was used. Indolene 30 and Indolene HO were blended in proportion to obtain approximately one-half gram of lead/gallon.

In order to insure consistent and accurate performance in conducting the program, a variety of information and schedule forms were provided to the test crews. Figure 3.1, Vehicle Control Log, is the form that was used

FIGURE 3.1

FORM 1.1

Vehicle Control Log

Test No. 1

Car No. 2

Curb Weight ____________ + 300 lbs = 3

Inertia Weight ______________ Indicated HP ________

1. Vehicle Identification

1.1 Year 4

1.2 Make 5

1.3 Model ______________

1.4 Color ______________

1.5 License No. ______________

1.6 Owner's Name ______________

1.7 Telephone No. ______________

1.8 Address ______________

1.9 Engine Size, CID 6

1.10 Horse power 7

1.11 Carb Make and Bbls 8 ,

1.12 Transmission Type 9

1.13 Exh. Emiss. Sys. 10

1.14 Crankcase Emiss. Sys. 11

2. Scheduling Information

		Reading	Date and Completed By
2.1	Odometer Reading	12	
2.2	Oil and Filter Changed (Use 10W-30 or 10W-40)	X REL	
2.3	Inflate Rear Tires to 45 psi		
2.4	Run Test 100-72 Cold Start	X	
2.5	Run Hot Orthogonal Test A	X	
2.6	Inspect Vehicle Completely Including Keymode Measurements on Dyno	X	
2.7	Repair and Tune Up, Install TC	X	
2.8	Reinspect Vehicle	X	
2.9	Run Test 101-72 Cold Start	X	
2.10	Run Hot Orthogonal Test B	X	
2.11	Set up Vehicle for Test Series	X	
	a. Determine Nominal Idle CO%		
	b. Install Valve on PCV System	X	
	c. Make Restricted Air Cleaner Increase CO by 0.5% at 50MPH	Fill Out Form 2.7	
	d. Measure Crankcase Pressure with PCV System Open and Closed	Fill Out Form 2.7	
	e. Measure Restricted and New Air Cleaner ΔP on Keymode Cycles	Fill Out Form 2.7	
	f. Determine Stabilized H_2O Temp.		

FIGURE 3.1 (Cont'd)

ORTHOGONAL TEST PROGRAM

FORM I.I (Continued)

		Reading	Date and Completed By
2.12	Run Orthogonal Experiments 1 through 24 and Baseline Tests C, D, and E	X	
2.13	Run 72 Cold Start Tests 102 through 107 Every Morning until Completed	X	
2.14	At end of Test Series:		
	a. Check CO with standard and restricted air cleaner	Fill Out Form 2.7	
	b. Measure Crankcase Pressure with PCV System Open and Closed	Fill Out Form 2.7	
	c. Measure Restricted and New Air Cleaner ΔP	Fill Out Form 2.7	
2.15	Make sure all forms are completed and in folder Send to Data Calculating Forms: 1.2, 1.3, 2.1, 2.5, 2.6, 2.7, 182	X	
2.16	Deinstrument Vehicle and Deflate Tires to Spec Record Odometer	X	

3. Special Instructions or Comments

to record vehicle specifications and control the sequence of test operations. Figure 3.2, Engine Parameter Deviation Check List, provided both the sequence of testing for each experiment and the actual parameter specifications required for each test run. The desired parameter specifications were filled in before the start of the experimental sequence and confirmed by the project engineer. The mechanic making the settings for each run entered the actual value obtained. This type of form was used for all of the Orthogonal, Stability and Cold Parameter tests.

3.3 INSTRUMENTATION AND TEST EQUIPMENT

The instrumentation and test equipment used for the Orthogonal Experiments was identical to that used in the performance of the Fleet Parameter Deterioration Study. Section 2.4 of that report describes the equipment.

3.4 DATA REDUCTION PROCEDURES

All CVS bag emission concentrations were recorded on continuous reading strip charts for later reduction. These emission concentration traces were hand read and the resulting mass emission calculations were made with the aid of a desk top computer. All of the calculations, including the NO_x humidity corrections, were made in accordance with the appropriate Federal Test Procedure.

3.5 TEST RESULTS AND CONCLUSIONS--HOT ENGINE PARAMETERS

Sixteen basic power trains equally proportioned between pre-emission controlled vehicles ('61-'65) and 1971 vehicles were tested. The rationale for selecting the test vehicles is presented in Section 3.1.2; their characteristics are summarized in Tables 3.2 and 3.4, respectively. The experimental designs differed slightly between these two control types to accommodate basic engine differences and to reflect the extent to which malfunctions were found in the engine parameter field experiments. The results of these experiments are discussed below for the three driving cycles (mass) and three diagnostic modes (concentration) investigated.

FIGURE 3.2

ENGINE PARAMETER DEVIATION CHECK SHEET

Car No. ________

Orthogonal Experiment
Pre-Controlled Vehicles

SPECIFICATION

Standard						Open		Normal =						
Positive Deviation						Open		Normal =						
Negative Deviation						Closed		Restricted =						
Intermediate Deviation														
Run	Completed	Timing		Idle RPM		PCV Valve Restriction		Air Cleaner Restriction		Idle CO%		Water Temp.	Air Cleaner Rest., %CO	Comments
		Des'd	Ach'd	Des'd	Ach'd	Des'd	Ach'd	Des'd	Ach'd	Des'd	Ach'd			
1						OPEN		NORMAL					X	
2						OPEN		RST'D					X	
3						CLOSED		NORMAL					X	
4						OPEN		RST'D					X	
5						OPEN		RST'D					X	
6						CLOSED		NORMAL					X	
7						OPEN		NORMAL					X	
8						OPEN		NORMAL					X	
C*						OPEN		NORMAL						
9						OPEN		RST'D					X	
10						CLOSED		RST'D					X	
11						CLOSED		NORMAL					X	
12						CLOSED		RST'D					X	
13						CLOSED		RST'D					X	
14						CLOSED		RST'D					X	
15						CLOSED		RST'D					X	
16						OPEN		NORMAL					X	
D*						OPEN		NORMAL						
17						OPEN		NORMAL					X	
18						CLOSED		RST'D					X	
19						OPEN		RST'D					X	
20						CLOSED		NORMAL					X	
21						CLOSED		NORMAL					X	
22						OPEN		NORMAL					X	
23						CLOSED		NORMAL					X	
24						OPEN		RST'D					X	
E*						OPEN		NORMAL						

* Emission Tests at Manufacturer's Specifications

The first order coefficients, derived from the analysis of variances of emissions measured using the Hot 1972 Federal CVS Procedure (hot start), are shown in Tables 3.10 through 3.21 for each engine parameter evaluated. These tables show the vehicles studied, the level of malfunction set, Hot 1972 CVS Procedure emissions response coefficients, $\Delta e_j/\Delta P_i$ in gm/mile/ΔP, and the level of significance for each of three emission species (HC, CO and NO_x).

3.5.1 Timing Maladjustment

The emission response coefficients obtained for changes in basic timing for pre-emission controlled and NO_x controlled vehicles are respectively presented in Tables 3.10 and 3.11. A response coefficient with a positive sign indicates that a positive change in basic timing (advance in timing) will cause an increase in emission. An advance in timing is seen to significantly influence all three emission species with HC and NO_x emissions increasing and CO decreasing. These changes are directly relatable to and are consistent with internal combustion engine phenomena. Lower CO results because of larger residence times associated with early ignition and more complete combustion; higher NO_x results because of higher peak temperatures and pressures resulting in greater N_2-0_2 fixation. HC emissions increase as a result of greater wall quenching of the fuel which in turn is caused by higher surface to combustion volume ratios.

The HC response coefficients across emission controlled vehicle power trains (700 Series vehicles) are with the exception of one six cylinder vehicle (706), very consistent. The average response was approximately 0.07 gms/mi/degree. CO and NO_x emission response coefficients are more highly variable. For those responses found to be statistically significant the higher values were roughly five to six times the lowest value. There is also a trend toward six cylinder vehicle CO and NO_x emissions being less responsive to timing advance than V-8 engines.

The 1971 vehicle data (800 Series vehicles) is summarized in a format similar to the pre-emission controlled vehicles in Table 3.11. Their response coefficients, on an average, are similar to those for pre-emission controlled vehicles in sign, range and magnitude. These vehicles are more

TABLE 3.10

72 FEDERAL HOT EMISSION RESPONSES TO TIMING, gm/mile/deg advanced

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/deg)		CO (gm/mile/deg)		NO_x (gm/mile/deg)	
		- degrees	+ degrees	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	- 6	11	.08701	99.9	-1.692	99.9	0.1200	99.9
FORD 8	702	0	17	.07686	99.9	-0.3386	95	0.3199	99.9
DODGE 8	703	0	17	.07328	99.9	-0.2666	70	0.2218	99.9
CHEVROLET 6	704	- 2	15	.08034	99	-.04770	<50	.02868	99.9
DODGE 6	705	-7.5	9.5	.06368	99.5	-0.8230	99.9	.07735	99.5
FORD 6	706	- 6	11	.03598	97.5	-0.4130	97.5	.06191	99.9
PONTIAC	707	- 4	13	.09747	99.9	-1.363	95	.1717	99.9
OLDSMOBILE	708	- 5	12	.08417	70	-1.504	99.5	.03494	99.9

TABLE 3.11

72 FEDERAL HOT EMISSION RESPONSES TO TIMING, gm/mile/deg advanced

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/deg)		CO (gm/mile/deg)		NO_x (gm/mile/deg)	
		deg$\overset{-}{\text{r}}$ees	deg$\overset{+}{\text{r}}$ees	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	- 10	7	$4.618\text{x}10^{-2}$	99.9	-1.304	99.9	0.1656	99.9
CHEVROLET	802	- 4	13	$6.718\text{x}10^{-2}$	99.9	-0.5644	99.9	0.2118	99.9
MERCURY	803	- 6	11	$7.390\text{x}10^{-2}$	99.9	-2.371	99.9	0.1345	99.9
AMC	804	- 5	12	$2.129\text{x}10^{-2}$	99.9	-1.020	99.9	0.1431	99.9
FORD	805	- 4	13	$6.338\text{x}10^{-2}$	99.9	-0.8435	99	$6.529\text{x}10^{-2}$	99.9
CHEVROLET	806	- 4	13	$6.176\text{x}10^{-2}$	99.9	-1.536	99.9	0.2044	99.9
PONTIAC	807	2	19	0.1584	99.9	$4.908\text{x}10^{-2}$	<50	0.1423	99.9
TOYOTA	808	0	17	$4.750\text{x}10^{-2}$	99.9	$-4.890\text{x}10^{-3}$	<50	0.1021	99.9
CHEVROLET	809	- 4	13	$7.040\text{x}10^{-2}$	99.9	-0.9857	99.9	0.2462	99.9

TABLE 3.12

72 FEDERAL HOT EMISSION RESPONSES TO IRPM, gm/mile/rpm increase

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/rpm)		CO (gm/mile/rpm)		NO_x (gm/mile/rpm)	
		rpm	rpm	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	400	550	-.006302	99.9	.05699	97.5	.00006352	<50
FORD 8	702	400	550	-.0007556	70	.06202	99.5	-.001222	<50
DODGE 8	703	400	550	-.001150	70	.05422	99	-.0007611	<50
CHEVROLET 6	704	400	550	-.006561	95	-.03717	95	.0003500	<50
DODGE 6	705	440	600	-.002370	70	.03485	95	-.001146	<50
FORD 6	706	425	575	-.0004000	<50	.03669	90	-.0008722	<50
PONTIAC	707	500	600	-.007633	90	.1171	80	.005622	90
OLDSMOBILE	708	370	510	-.01204	75	-.04767	65	-.0001524	<50

TABLE 3.13

72 FEDERAL HOT EMISSION RESPONSES TO IRPM, (gm/mile/rpm)

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/rpm)		CO (gm/mile/rpm)		NO_x (gm/mile/rpm)	
		- rpm	+ rpm	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	560	770	-1.310×10^{-4}	<50	1.215×10^{-2}	<50	-1.369×10^{-4}	<50
CHEVROLET	802	600	440	-3.880×10^{-4}	<50	4.983×10^{-2}	99.9	3.618×10^{-3}	<50
MERCURY	803	660	480	1.090×10^{-3}	60	9.344×10^{-2}	99.0	2.993×10^{-3}	53
AMC	804	660	480	-4.896×10^{-4}	99.2	1.234×10^{-2}	66	4.201×10^{-4}	<50
FORD	805	660	480	2.097×10^{-3}	99.8	7.836×10^{-2}	99	-4.181×10^{-3}	99.8
CHEVROLET	806	605	440	-1.318×10^{-3}	98	1.139×10^{-2}	50	-1.780×10^{-4}	<50
PONTIAC	807	770	560	-3.324×10^{-3}	99.6	4.884×10^{-3}	50	4.771×10^{-3}	99.8
TOYOTA	808	715	520	-3.846×10^{-4}	90	7.721×10^{-3}	97	9.744×10^{-4}	65
CHEVROLET	809	605	440	1.629×10^{-4}	<50	9.992×10^{-3}	65	4.030×10^{-3}	99.8

TABLE 3.14

72 FEDERAL HOT EMISSION RESPONSE TO IDLE CO (- TO 0), (gm/mile/%)

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/%)		CO (gm/mile/%)		NO_x (gm/mile/%)	
		- %	0 %	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	5.3	6.3	.5956	99.5	9.411	95	-0.7220	99
FORD 8	702	3.8	4.8	.1575	60	5.325	90	-1.904	95
DODGE 8	703	4.3	5.3	-.08000	<50	-1.974	<50	-0.7588	<50
CHEVROLET 6	704	4.0	5.0	.4900	55	5.402	90	.02125	<50
DODGE 6	705	5.0	6.0	.6000	80	6.434	95	.5562	70
FORD 6	706	3.8	4.8	.2475	<50	-0.4125	<50	.1350	<50
PONTIAC	707	3.8	4.8	.6955	75	-0.8989	<50	-1.135	99
OLDSMOBILE	708	3.8	4.8	.9202	<50	15.64	90	-.06788	<50

TABLE 3.15

72 FEDERAL HOT EMISSION RESPONSE TO IDLE CO (0 TO +), (gm/mile/%)

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC. (gm/mile/%)		CO (gm/mile/%)		NO_x (gm/mile/%)	
		0 %	+ %	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	6.3	8.8	.4797	99.5	6.927	99.9	.02732	<50
FORD 8	702	4.8	7.3	.3430	99.9	4.881	99.9	1.285	99.5
DODGE 8	703	5.3	7.8	.3725	99.9	7.377	99.9	.3030	<50
CHEVROLET 6	704	5.0	7.5	.5130	95	4.275	99.5	-.1910	95
DODGE 6	705	6.0	8.5	.9550	99.9	5.023	99.9	-.3350	75
FORD 6	706	4.8	7.3	.5215	99.9	3.486	97.5	-.05800	<50
PONTIAC	707	4.8	7.3	.6596	99.5	6.244	75	.2101	75
OLDSMOBILE	708	4.8	7.3	.1644	<50	3.299	65	-.01648	<50

TABLE 3.16

72 FEDERAL HOT EMISSION RESPONSE TO IDLE CO (- TO +), (gm/mile/%)

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/%)		CO (gm/mile/%)		NO_x (gm/mile/%)	
		- % v	+ % v	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	0.5	3.5	.1450	99.8	5.978	99.9	4.917×10^{-2}	<50
CHEVROLET	802	0.5	3.5	0.1496	99.5	8.780	99.9	-0.6651	98
MERCURY	803	0.2	2.7	0.1255	78	6.976	99.0	0.2015	50
AMC	804	0.5	3.0	3.075×10^{-2}	98	3.380	99.9	-0.1048	75
FORD	805	0.2	2.7	9.800×10^{-2}	98	6.513	99.5	-8.100×10^{-2}	85
CHEVROLET	806	0.5	3.0	0.1310	99.9	6.773	99.9	7.475×10^{-2}	66
PONTIAC	807	0.5	3.0	-4.725×10^{-2}	<50	9.525	99.9	-3.875×10^{-2}	<50
TOYOTA	808	2.0	4.5	1.800×10^{-2}	55	1.836	99.9	-4.600×10^{-2}	<50
CHEVROLET	809	0.5	3.0	0.1302	99.9	5.867	99.9	0.1610	96

TABLE 3.17

72 FEDERAL HOT EMISSION RESPONSE TO AIR CLEANER RESTRICTION, (gm/mile/deg)

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/deg)		CO (gm/mile/deg)		NO_x (gm/mile/deg)	
		- degrees	+ degrees	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	180	0	.0001305	<50	.05822	99.5	.002337	95
FORD 8	702	180	10	.002196	95	.04137	99	.004341	<50
DODGE 8	703	180	0	.0002823	<50	-.004370	<50	-.0005414	<50
CHEVROLET 6	704	170	105	.006244	55	.05658	75	-.002474	70
DODGE 6	705	180	0	.003495	90	.1245	99.9	-.005712	97.5
FORD 6	706	140	40	.006583	97.5	.1343	99.9	-.008294	99.5
PONTIAC	707	110	0	.003665	60	.1447	90	-.01523	99.9
OLDSMOBILE	708	180	0	.03365	99.9	.4114	99.9	-.002423	99

TABLE 3.18

72 FEDERAL HOT EMISSION RESPONSE TO AIR CLEANER RESTRICTION, (gm/mile/deg)

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/deg)		CO (gm/mile/deg)		NO_x (gm/mile/deg)	
		- degrees	+ degrees	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	0	145	1.733×10^{-3}	93.4	.1106	99.9	-4.896×10^{-3}	99.8
CHEVROLET	802	0	180	1.891×10^{-3}	99.9	.01072	<50	1.719×10^{-3}	<50
MERCURY	803	180	0	1.701×10^{-3}	78	.08644	98	-5.382×10^{-3}	90
AMC	804	15	185	1.151×10^{-3}	99.9	.05263	99.9	-2.694×10^{-3}	98
FORD	805	0	180	2.152×10^{-3}	99.8	.07114	98	-1.583×10^{-3}	94
CHEVROLET	806	0	180	7.568×10^{-4}	90	.03670	99	6.977×10^{-4}	50
PONTIAC	807	0	180	8.713×10^{-4}	50	.08698	99.9	-2.754×10^{-3}	90
TOYOTA	808	85	180	-2.632×10^{-4}	<50	.02393	99.8	-2.158×10^{-3}	70
CHEVROLET	809	0	175	1.303×10^{-3}	99.9	.05901	99.9	-4.929×10^{-4}	<50

TABLE 3.19

72 FEDERAL HOT EMISSIONS RESPONSE TO PCV RESTRICTION, (gm/mile/cfm)

PRE-EMISSION CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/cfm)		CO (gm/mile/cfm)		NO_x (gm/mile/cfm)	
		− cfm	+ cfm	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
CHEVROLET 8	701	0	4.220	-.0303	50	1.527	90	-.1092	97.5
FORD 8	702	0	3.367	.0594	55	1.445	90	.2970	65
DODGE 8	703	0	2.331	.01251	<50	2.438	80	.1019	<50
CHEVROLET 6	704	0	4.662	-.1160	65	1.607	99.5	-.06988	99
DODGE 6	705	0	1.554	.2687	75	5.897	99.5	-.2080	55
FORD 6	706	0	1.036	-.5567	95	2.685	55	.3998	75
PONTIAC	707	0	2.072	.1698	55	5.786	80	.1934	75
OLDSMOBILE	708	0	2.331	.008361	<50	6.559	95	-.02653	<50

TABLE 3.20

1972 FEDERAL HOT RESPONSE COEFFICIENTS TO PCV RESTRICTION, (gm/mile/cfm)

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/cfm)		CO (gm/mile/cfm)		NO_x (gm/mile/cfm)	
		− cfm	+ cfm	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	1.554	0	-.1673	94.2	-7.722	99.7	.6234	99.9
CHEVROLET	802	4.921	0	-.1055	99.9	-2.054	99.9	.03079	<50
MERCURY	803	0	3.108	-.1943	99.2	-8.301	99.9	.3117	90
AMC	804	2.072	0	-.09020	99.9	-1.9150	96	.1481	91
FORD	805	3.108	0	-.1504	99.9	-5.447	99.6	.08366	92
CHEVROLET	806	6.216	0	-.06515	99.9	-.4543	70	-.01639	<50
PONTIAC	807	2.849	0	-.1213	83	-7.915	99.9	.08701	50
TOYOTA	808	0.513	0	-.2075	98	-7.363	99.9	-.4971	90
CHEVROLET	809	2.849	0	-.09674	99.9	-1.873	99.9	-3.071	<50

TABLE 3.21

1972 FEDERAL HOT RESPONSE COEFFICIENTS TO FAILURE OF THE NO_X CONTROL, (gm/mile/unit)

1971 NO_X CONTROLLED VEHICLES

MAKE	VEHICLE NUMBER	INCREMENT		HC (gm/mile/unit)		CO (gm/mile/unit)		NO_x (gm/mile/unit)	
		-	+	LEVEL	SIGN.	LEVEL	SIGN.	LEVEL	SIGN.
DODGE	801	Operative	Failed	.1337	50	-8.763	97	0.8375	99.9
CHEVROLET	802	Operative	Failed	0.6949	99.9	-1.335	<50	0.2510	<50
MERCURY	803	-	-	-	-	-	-	-	-
AMC	804	Operative	Failed	7.438×10^{-2}	98	-10.87	99.9	1.209	99.9
FORD	805	-	-	-	-	-	-	-	-
CHEVROLET	806	Operative	Failed	0.5612	99.9	-8.661	99.9	0.4294	99.7
PONTIAC	807	Operative	Failed	0.9731	99.9	-8.134	99.6	0.3844	75
TOYOTA	808	Operative	Failed	0.6550	99.9	3.104	99.9	2.081	99.9
CHEVROLET	809	Operative	Failed	0.6844	99.9	-9.405	99.9	1.806	99.9

retarded under part load acceleration than pre-emission controlled vehicles because of the NO_x control device but have similar average emission responses to basic timing. Accelerations occur approximately 30 percent of the time in the LA-4 driving cycle. This suggests that the response in this operating mode is linear and not dependent on the absolute value of timing. Further, any additional effect of defeating advance is directly additive.

Population weighted emission responses for both control types are summarized below to illustrate the average effect of timing. These values are calculated by weighting the individual responses of the vehicles tested by the frequency with which their power trains are found in the national population.

POPULATION WEIGHTED EMISSION RESPONSES
TO TIMING ADVANCE, g/mile/degree

Control Type	HC	CO	NO_x
Pre-emission Controlled Vehicles	0.066	-0.85	0.14
NO_x Controlled Vehicles	0.078	-0.90	0.15

The composite responses show that adjusting advanced timing in a mandatory program can affect substantial reductions in NO_x and HC for the entire vehicle population and would, therefore, be expected to be an attractive procedure for regions with photochemical smog.

3.5.2 Idle Speed Maladjustment

The influence of increasing Idle RPM upon emissions measured using the 1972 Federal Procedure is shown in Tables 3.12 and 3.13 for pre-emission controlled vehicles and NO_x controlled vehicles, respectively.

Pre-emission controlled vehicles are seen to vary considerably with respect to their emission sensitivity to this variable. HC mass emissions, contrary to concentration emissions, are less sensitive to idle speed. Only three vehicles had responses which were statistically significant at the 90 percent level or greater--their values are negative and within 15 percent of their average. The CO response is consistently significant (6 out of 8 vehicles) and positive in sign, indicating that increasing slow idle speed to the specification value will increase CO mass emissions. NO is substantially unaffected by this adjustment.

Similar characteristics were obtained with the 1971 (NO_x controlled) vehicles, the most substantial influence again being CO emissions. The influence of idle speed on HC emissions is more highly variable and, on the average, less sensitive. Summary of the composite responses to idle speed is presented below.

POPULATION WEIGHTED EMISSION RESPONSES
TO IDLE SPEED

Control Type	HC	CO	NO_x
Pre-emission Controlled Vehicles	-.0029	.029	.00073
NO_x Controlled Vehicles	-.0005	.028	.00066

3.5.3 Idle Fuel-to-Air Maladjustment

The idle fuel-to-air ratio adjustment is usually set simultaneously with idle speed. The net influence must therefore consider both adjustments. The effect of idle fuel-to-air maladjustment on emissions of pre-emission controlled vehicles was investigated at three levels because this maladjustment was found to be more extensive in the engine parameter field survey (Reference 10) and, therefore, thought to be potentially nonlinear. The results are presented over two intervals: 1) lean of specification, Table 3.14, and 2) rich of specification, Table 3.15, for fuel-to-air ratios measured as volume percent CO. Idle fuel-to-air was measured as CO since this measurement can be made precisely with NDIR instruments and most mass emissions vary linearly in this parameter. At the lower range of Idle CO setting, Table 3.14, emission responses to Idle CO were not frequently found to be statistically significant and highly variable across vehicles. This is most likely caused by the relatively small difference in the range of the - and 0 settings (1% v CO) and consequent small emission difference relative to experimental variability. For the higher range of the variable, Table 3.15, respectively seven and six statistically significant responses out of eight HC and CO vehicle emission responses resulted. Both emissions increase as idle fuel is increased with the influence being strongest for CO. Indeed, the most cost effective maintenance action for controlling CO is an idle fuel-to-air ratio adjustment as shown in Volume II.

Interestingly, the three six cylinder vehicles (Nos. 704, 705 and 706) have negative NO_x responses, one of which is statistically significant. All except one of the V-8s have positive influences, with one of five statistically significant. The results are anomalous because one would have anticipated NO_x to vary oppositely with CO. More complete combustion with its associated higher temperatures in the idle and partially loaded operations of the vehicle should result in greater NO_x formation.

The influence of Idle CO on NO_x was indeed indicated for the 1971 NO_x controlled vehicles, Table 3.16; however, there were only two vehicles with statistically significant responses but with opposite signs. As is indicated in the summary below, the influence of Idle CO on HC is significantly less with NO_x controlled vehicles and CO slightly greater than for pre-emission controlled vehicles.

POPULATION WEIGHTED EMISSION RESPONSE
TO IDLE FUEL-TO-AIR RATIO, gm/mi/% v

Control Type	HC	CO	NO_x
Pre-emission Controlled Vehicles	.44	4.03	.21
NO_x Controlled Vehicles	.067	6.53	-.034

The progressively lower HC response is a typical emission characteristic of internal combustion engines as stoichiometric fuel-air mixture is approached from the rich side, Reference 11. Under these conditions the HC change is highly non-linear and may be asympotic or may change slope sign as stoichiometric mixture is approached.

3.5.4 Air Cleaner Restriction

The emission response to air cleaner restriction is shown in Tables 3.17 and 3.18. The degree of restriction is based upon a determination of pressure drop across the element as measured on an AC tester.

HC emission responses of pre-emission controlled vehicles to air cleaner restriction, Table 3.17, are statistically significant for 50 percent of the vehicles tested. Two of three six cylinder vehicles have significant effects. All but two vehicles, Nos. 703 and 704, had CO emission responses which were statistically significant. All vehicles with statistically significant CO responses with the exception of vehicle 701 had statistically significant NO_x responses of opposite sign. These results are internally consistent with known NO_x combustion chemistry. With high engine load, where air cleaner restriction has the greatest influence, fuel rich operation will suppress peak temperatures and thus reduce NO at the expense of increased CO. The variability in the statistically significant emissions responses across vehicles is largest (nearly a factor of 10 in absolute magnitude) for HC and NO_x and smallest for CO. Emissions response of all species to air cleaner restriction has the largest variability across vehicles of any of the engine parameters investigated.

In comparison to pre-emission controlled vehicles a large number of the 1971 vehicles had a significant ($\geq$ 90%) HC and CO responses to air cleaner restriction, Table 3.18. Both HC and CO emissions responses are substantially lower on average than those for pre-emission control vehicles, Table 3.18. One basic power train, a 350 CID V-8 (vehicle nos. 802, 806 and 809) consistently had HC and CO emissions responses which were significant but not for NO_x emissions.

The population weighted results, summarized below, suggest that air cleaner maintenance will affect substantial reductions in CO, but probably will not be as effective as an idle fuel-to-air adjustment This repair will be more effective on older vehicles and will result in some increase in NO_x emissions.

POPULATION WEIGHTED EMISSION RESPONSES
TO AIR CLEANER RESTRICTION, gms/mi/deg

Control Type	HC	CO	NO_x
Pre-emission Controlled Vehicles	.0057	.112	-.0030
NO_x Controlled Vehicles	.00089	.069	-.0024

3.5.5 Positive Crankcase Ventilation (PCV) Restriction

Restrictions in the PCV system result in carburetor metering upsets which can significantly affect CO and NO_x emissions. This influence can be adjusted out of the closed throttle operating modes using the idle fuel to air adjustment screws. The emission response coefficients presented in Tables 3.19 and 3.20 reflect this situation. These coefficients were developed by dividing the emission changes by the PCV flow rate measured with the vehicle operating in the Clayton 49/45 MPH Cruise and is therefore based on the assumption that changes in emission with changes of this variable are linear. This assumption was discussed in Reference 12.

The major effect of restricted PCV on emissions of pre-emission controlled vehicles is to increase CO. Sixty-six percent of the vehicles had response coefficients significant at $\geq$90 percent confidence limit. Both HC and NO_x emission responses were highly variable in both sign and magnitude; however, only three were statistically significant at the $\geq$90 percent confidence level. The two vehicles which indicated significant negative NO_x responses had consistent positive CO responses.

The NO_x controlled vehicles have a larger number of statistically significant responses and quantitatively larger response to PCV restriction. These results are believed to be due to the fact that carburetion on NO_x control vehicles is substantially leaner over the LA-4 drive cycle. Metering upsets, therefore, are more sensitive relative to the more rich carburetion of uncontrolled vehicles. It should be noted that the average volumetric flow rates for both vehicle sets are similar, i.e., respectively 2.70 and 3.02 cfm for pre-emission controlled and NO_x controlled vehicles. Thus, actual flow changes relative to carburetor total flow should be approximately equal for both exhaust control vehicle sets. The weighted average emission responses, summarized below, indicate that CO and NO_x emission responses are approximately three times larger for the NO_x controlled vehicles.

POPULATION WEIGHTED EMISSION RESPONSES
TO PCV RESTRICTION, gms/mi/cfm

Control Type	HC	CO	NO_x
Pre-emission Controlled Vehicles	.060	-1.91	.029
NO_x Controlled Vehicles	-.122	-6.01	.105

3.5.6 NO_x Spark Retard System

A number of the 1971 vehicles are equipped with a system for overriding the spark advance line during part load accelerations. A failure analysis of this system suggested that most component malfunctions (vacuum sensor, electric soloid, etc.) will result in a complete malfunction. Therefore, response coefficients, Table 3.21, are given over the nominal to failed range of this parameter.

The results indicate that all emissions are significantly affected. HC and NO_x mass emissions are affected in a nearly identical manner as for retarded timing--the influence is typically as effective as retarding basic timing 3 to 7 degrees. The results are fairly consistent across power train for domestic automobiles. The only import, vehicle 808, showed the largest response (e.g., it had the most effective NO_x control) to NO_x. For this vehicle CO was indicated to have been reduced also, with a small but highly significant positive value of 3 gm/mi. This is contrasted to negative (increasing) values of nominally - 8 gm/mi for domestic vehicles.

3.5.7 Influences of Other Operating Modes

Other operating modes (driving cycles and steady-state) were investigated to determine the influence of malfunctioned engine parameters on mass and concentration emissions.

The original California 7-Mode and the EPA Short Cycle emissions were measured using the CVS Procedure, and concentration measurements were made at three constant speed (keymode) conditions. These data are presented in detail in Appendix A and discussed at their weighted population level in the following paragraphs.

Constant Speed Modes

Concentration measured emission responses in constant speed (key) operating modes are an important secondary input to the economic effectiveness model. They permit the transformation of engine parameter maintenance and deterioration actions to changes in the means and variances of these inspectable quantities. They are also useful in the identification and screening of emission inspection modes. Obviously, if an engine parameter does not significantly affect one of these modes, it is unlikely that a field emission inspection will identify it with high degree of reliability.

Table 3.22 presents a comparison weighted population emission responses to the engine parameter and engine control systems investigated. It is significant to note that with some few exceptions, engine parameter malfunctions influence emission modes similarly for both pre-emission controlled and NO_x controlled vehicles. Thus, it is reasonable to anticipate that the same emission inspection procedures will be applicable to both groups. Of course, because of the substantially lower exhaust emissions of '71 vehicles, the pass/fail criteria must be set correspondingly lower.

Generally, ignition timing related malfunctions (basic timing and NO control) most strongly affect HC and NO_x. Upsets of the carburetor fuel metering system can most readily be detected by changes in CO, although certain malfunctions when repaired such as air cleaner restriction can substantially increase NO_x.

The probable diagnostic content of the several emission modes as reflected by significant responses to malfunction may be summarized as follows:

- CO measurements in the loaded modes tend to discriminate with the most sensitivity induction system components affecting fuel to air ratio; although the simultaneous measurement of HC may improve the diagnosis.
- Advanced timing substantially influences NO_x and moderately increases HC under load--an idle HC emission measurement should be more sensitive to advanced timing than a HC measurement under load.
- There is no particularly strong emission signature for slow idle speed, the best being on idle HC emission measurement.

TABLE 3.22

Emission Response to Engine Parameters in Two Constant Speed Operating Modes

		Emission Response to Operating Mode, e_m/P_i			
		49/45 MPH Cruise Mode		Idle Mode	
Engine Parameter	Emission	Pre-emission Controlled Vehicles	NOX Controlled Vehicles	Pre-emission Controlled Vehicles	NOX Controlled Vehicles
Timing	HC, ppm	4.20	4.05	17.8	11.5
	CO, %	- .0086	- .0116	.0032	.00031
	NO_x, ppm	73.4	91.6	.735	.429
Idle speed	HC, ppm	- .022	- .023	-1.66	-.342
	CO, %	0	0	0	-.0042
	NO_x, ppm	.201	- .043	.058	.386
Idle F/A	HC, ppm	- 2.25	.603	34.8	13.5
	CO, %	.0132	- .011	.900	1.03
	NO_x, ppm	0	- 1.77	- 9.44	-38.3
PCV	HC, ppm	- 5.19	- 6.85	0	- 2.96
	CO, %	- .053	- .142	- .0136	- .0125
	NO_x, ppm	-72.3	53.8	- 1.04	- 3.94
Air Cleaner	HC, ppm	.080	.086	.047	- .094
	CO, %	.0016	.0029	0	.00008
	NO_x, ppm	- .925	- .695	- .0079	- .044
NO_x	HC, ppm	--	11.2	--	105
	CO, %	--	- .015	--	.025
	NO_x, ppm	--	313	--	40

☐ emission mode(s) with greatest relative sensitivity

▨ best mode

- The best emission measurement for idle F/A is idle CO, although a combination of idle HC and CO may improve the diagnosis.
- Emission inspections may be more effective with newer vehicles since a number of the emission responses to malfunction are larger than for the older pre-emission controlled vehicles and the average emissions levels are substantially less (i.e., the signal to noise ratio is higher, sometimes by a factor of 3). This influence will, however, be partially offset by the lower frequency and extent of engine parameter malfunction for newer vehicles as indicated in the engine parameter field survey (Refercne 10).

The above conclusions substantially validate the analyses of emission signatures derived from the parameter field survey, Section 2.6.3. The conclusions are based upon emission responses normalized relative to average, vehicle population emission levels for the respective modes as measured in the engine deterioration fleet, as received tests (see Section 2.6.1). As an example, normalized timing emission response is shown below; and has the units of percent change in average concentration per degree of timing advanced.

NORMALIZED EMISSION RESPONSE
TO TIMING, %/change/degree

	49/45 MPH		Idle	
Emission	Pre-Emission Controlled	NO_x Controlled	Pre-Emission Controlled	NO_x Controlled
HC	1.1	3.0	1.95	4.7
NO	4.4	3.6	.6	.3

Clearly, relative to their average base line emissions the Idle HC, loaded NO_x, or a combination thereof would be expected to yield the best inspection procedure (i.e., one which minimizes errors of omission and commission).

Alternate Driving Cycles

Composite emission responses associated with more complex driving cycles, as suggested by the previous discussion, would be expected to be functionally dependent on the fraction of time vehicles are operated in specific modes. This may be seen by the fact that emission responses vary widely over the range of Idle to 45 MPH. For example, virtually no carryover of idle fuel to air as measured by Idle CO is seen at 45 MPH--thus a vehicle operating only at higher load would not be sensitive to this failure.

The influence of two short driving cycles on emissions responses is presented in Table 3.23. Some characteristic attributes of these cycles are also shown such as the percent of time in idle and acceleration modes and the average cycle speed. Although both cycles have approximately the same average speed, the closed California 7-Mode is operated at higher horsepower (higher fraction of open throttle). This fact is reflected in generally larger values of emission response of engine parameters affected by engine load. For example, the induction system related engine parameters of restricted PCV and air cleaner consistently have large responses under load as measured in the 7-Mode cycle as compared to the EPA Short Cycle. A similar effect is reflected in ignition timing related malfunctions relative to NO_x emissions under load--the greater the load, the more effective retarding the timing would be in a mandatory maintenance program.

The converse does not seem to be true for engine parameters affecting closed throttle operation in the EPA Short Cycle (i.e., the larger percentage closed throttle operation does not result in larger idle parameter connected response coefficients such as idle speed).

It should also be noted that a substantial factor in explaining the emissions variability within populations of power train families is the variability in their maintenance state. This maintenance variability can be transformed into emissions variability through the use of the emissions response coefficients previously discussed. This approach is used in the statistical model subroutine discussed in Volume II.

3.5.8 Experimental Error

Two types of errors, precision and accuracy, are of concern with regard to the statistically determined emission responses previously discussed. A measure of experimental precision (repeatability) may be obtained by evaluating the residual error derived from the analyses of variances. This error is significant because it reflects the precision with which the response coefficients have been established. A quantitative

TABLE 3.23

Comparison of Emission Response in Two Driving Cycles

Characteristic		Emission Response, $\partial e_j/\partial P_i$			
		7-Mode CVS		EPA Short	
		Uncontrolled	71	Uncontrolled	71
% idle-closed throttle		46.7		50.7	
% open throttle		53.3		49.3	
avg. speed		21.9		21.7	
Timing	HC	.056	.094	.069	.086
gms/mi/deg.	CO	- 1.077	-1.084	- .300	- .557
	NO_x	.145	.134	.106	.087
idle speed	HC	- .0079	- .00471	- .0053	- .0013
gms/mi/rpm	CO	.047	.0236	.035	.023
	NO_x	0	0	0	0
idle F/A	HC	.879	- .050	.447	.068
gms/mi/%CO	CO	7.47	7.85	5.45	7.14
	NO_x	.075	- .080	- .0056	- .040
PCV	HC	- .065	- .060	- .023	- .120
gms/mi/cfm	CO	.915	-3.51	-1.50	-2.91
	NO_x	- .012	.121	.021	.098
air cleaner	HC	.0058	.00076	.0059	.0072
gms/mi/deg	CO	.102	.056	.093	.036
	NO_x	- .0015	- .0024	- .0018	- .0002
NO_x	HC	--	.583	--	.404
gms/mi/failure	CO	--	-3.44	--	-2.34
	NO_x	--	.662	--	.400

measure of accuracy may be derived by testing two identical power trains in two different, but similar vehicles, with an identical fractional factorial experiment. Both analyses are discussed below.

Experimental Precision

Noise in the experiment program may result from four sources. These are instrumentation, drive cycle repeatability, test set-up and inherent vehicle variability. In a statistical designed experiment which is carefully controlled, the greatest error source would be anticipated to be that of basic vehicle emission stability. A measure of basic vehicle emission stability, which represents the combined uncertainties of both vehicle and instrumentation, was obtained by restoring each vehicle to specification and measuring emissions in four equally spaced tests during the orthogonal experiment. The estimate of variance obtained from these tests is referred to as the stability variance. A comparison of the residual and stability variances that resulted with each of the vehicles with all of the test cycles is presented in Appendix B. Most of the values indicated that the inherent vehicle and measurement uncertainty, i.e., stability variance, was not significantly different than the residual variance. There were, however, cases in which anomolies occurred. For ease of reference the residual and stability variances of those vehicles that exhibited anomolies with the 1972 Federal Test Procedure and the 7-Mode CVS Test Procedure are presented in Table 3.24.

The residual variance term, in general, was found to be within a factor of two of the standard variance derived from the stability tests. For the 700 series vehicles, HC and NO_x emissions residual variances are greater than the stability variances about 50 percent of the time. All but one vehicle had CO residual variances greater than stability. Vehicles 703, 707 and 708 had either residual CO or HC variances substantially greater than the stability tests. Differences were significant at a high level of statistical significance. For these cases either the stability variances were abnormally low or the sums of squares were abnormally high. The residual variances relative to the sum of squares (S.S.) are more typical. However, the residual variances obtained with HC on Vehicle 708 and CO on Vehicle 707 appear excessive. It must be concluded that

TABLE 3.24

SUMMARY OF VEHICLES
WITH STATISTICALLY SIGNIFICANT DIFFERENCES IN VARIANCES

VEHICLE NO.	EMISSION	1972 FEDERAL HOT		7-MODE	
		RESIDUAL	STABILITY	RESIDUAL	STABILITY
701	HC	.150	.23	0.46*	1.64
	CO	62	46	71	31
	NO	.20*	1.09	.063*	.304
703	HC	0.08	0.18	1.28	0.35
	CO	45*	3.2	40	8
	NO	5.5	2.4	0.57	0.44
704	HC	1.13	1.38	.56*	2.2
	CO	31	27	35	35
	NO	.065	.18	.11	.12
707	HC	.84	.31	.44	.43
	CO	377*	8.8	315	46
	NO	.50	1.25	.41	.59
802	HC	.028	.13	.072	.0057
	CO	14.7*	.001	3.81	.0003
	NO	1.44	1.62	.61	1.06
805	HC	.018	.092	.075	.097
	CO	79	.75	49*	3.2
	NO	.042	.099	.048	.086
806	HC	.051	.081	.070	.019
	CO	40	17	83*	7.2
	NO	.13	.48	.13	.13

* Statistically different variance pair at the 95 % level.

noise over and above base vehicle emission stability is entering into this data, either through procedures or higher order interactions, on roughly 50 percent of the tests. However, even in these cases the residual error rarely exceeds two percent of the sum of squares.

The 800 series vehicle emission variances had characteristics similar to the 700 series vehicles, however, only about 40 percent of these vehicles had residual variances greater than stability variances. The residual variances again rarely exceeded the stability by a factor of two. There were three cases where the variance differences were statistically significant (see * values).

As is shown in Table 3.24 the 7-Mode mass emissions, which are similar to the '72 Federal test emissions in response and average level also have characteristically similar variances. There are, however, a fewer number of residual variances of lower value. Further, the vehicles with statistically significant differences in emission variances do not usually match up between the two driving cycles.

In general, those vehicles which had high variance pairs, i.e., residual vs. stability different at a high level of statistical confidence for one drive cycle, had large differences in the other. Only two vehicles (701 and 805), however, had statistically different emission variance pairs simultaneously in both cycles. No one drive cycle shows consistently lower variances than the other. Thus, drive cycle repeatability does not appear to be a significant error source. The fact that only 10 percent of the variance pairs had statistically different values demonstrates that the orthogonal experiments were conducted with errors not greatly exceeding the inherent emission variabilities due to instability of vehicles or measurement and test uncertainties.

Experiment Accuracy

A basic premise which allows development of the empirical data that support the economic effectiveness model is that emission responses to malfunctions are inherent characteristics of families of power trains. That is, a 350 cubic inch V-8 will have the same response characteristics in a medium size vehicle as a standard vehicle or in a well maintained vehicle as in a poorly maintained one.

A comparison of emission response for the three vehicles which had identical drive trains is presented in Tables 3.25, 3.26 and 3.27. As previously described in Section 3.1.3, the experimental design utilized for Vehicle 802 consisted of a one-quarter fractional factorial experiment whereas Vehicles 806 and 809 were tested with a one-half fractional factorial experiment. Potential confounding, therefore, could influence the values of the main effects presented for Vehicle 802. A comparison of the results with the three vehicles, to a fair degree, substantiates the basic premise.

To determine the uncertainty associated with the predicted main effects, the individual residual variances (Appendix B) for each orthogonal experiment were pooled. On the basis of the pooled residual variance, an estimate of the standard deviation was developed and a tolerance band, based upon the normal deviate, was made. The resulting 90 percent confidence band is included as a footnote in each of the tables.

The main effects for HC measured with a Hot 1972 Federal CVS Procedure for the three identical drive train vehicles, are presented in Table 3.25. The maximum and minimum values of the main effects of all of the nine vehicles tested are presented for contrast with the three identical engines. In addition, it is noted that a difference of 0.5 gm/mile is significant at the 90 percent confidence level. The data show the range of the main effects of all nine vehicles were significantly different for timing, idle rpm, PCV and NO_x control devices. In contrast, the range of the main effects measured with the three vehicles with identical drive trains showed no cases in which significant difference were measured.

The main effects obtained for CO, using the Hot 1972 Federal CVS Procedure also indicated good agreement for the three vehicles with identical drive trains relative to the range for the nine vehicles, Table 3.26. A deviation of 10.7 gm/mile is required to state that there is a significant difference in main effect. All of the main effects between the nine vehicles showed significant differences between the minimum and maximum values. The main effects developed for the three comparable 1971 Chevrolet vehicles showed no cases of significant difference.

TABLE 3.25

REPEATABILITY OF ORTHOGONAL EXPERIMENT RESULTS WITH LIKE POWER TRAINS

1971 Chevrolet (350 cu. in.)
HC Hot 1972 Federal CVS Procedure

PARAMETER	SIGNIFICANT MAIN EFFECTS, gm/mile			RANGE OF 800 VEHICLES	
	VEHICLE 802	VEHICLE 806	VEHICLE 809	MINIMUM	MAXIMUM
TIMING	1.1415	1.050	1.197	0.3619 *	2.693 *
IDLE RPM	—	0.2175	—	-0.3775 *	0.6981 *
PCV	0.5195	0.4050	0.2756	0.1075 *	0.6038 *
AIR CLN	0.3404	0.1362	0.2281	0.1362	0.3875
IDLE CO	0.3740	0.3275	0.3256	0.07688	0.4350
NO_X CONTROL	0.6914	0.5612	0.6844	0.07438 *	0.9731*
TOTAL SUMS OF SQUARES	16.09	16.55	18.43	2.386	84.95
MEAN SQUARE RESIDUAL	0.02812	0.05132	0.02507	0.06753	0.3726

* A DIFFERENCE OF 0.51 gm/mile IS SIGNIFICANTLY DIFFERENT AT THE 90 % CONFIDENCE LEVEL

TABLE 3.26

REPEATABILITY OF ORTHOGONAL EXPERIMENT RESULTS WITH LIKE POWER TRAINS

1971 Chevrolet (350 cu. in.)
CO Hot 1972 Federal CVS Procedure

PARAMETER	SIGNIFICANT MAIN EFFECTS, g/mile			RANGE OF 800 VEHICLES	
	VEHICLE 802	VEHICLE 806	VEHICLE 809	MINIMUM	MAXIMUM
TIMING	-9.596	-26.11	-16.76	-40.30 *	-9.596 *
IDLE RPM	-7.973	—	—	-16.82 *	-1.506 *
PCV	10.11		5.337	3.814 *	25.80 *
AIR CLN	—	6.606	10.33	1.931 *	15.66 *
IDLE CO	21.85	16.93	14.67	4.589 *	21.85 *
NO_X CONTROL	—	-8.661	-9.405	-9.405 *	3.104 *
TOTAL SUMS OF SQUARES	4889	10700	6660	707.4	15100
MEAN SQUARE RESIDUAL	14.70	40.33	12.02	2.922	101.3

* A DIFFERENCE OF 10.7 g/mile IS SIGNIFICANTLY DIFFERENT AT THE 90 PERCENT CONFIDENCE LEVEL

TABLE 3.27

REPEATABILITY OF ORTHOGONAL EXPERIMENT RESULTS WITH LIKE POWER TRAINS

1971 Chevrolet (350 cu. in.)
NO_x Hot 1972 Federal CVS Procedure

PARAMETER	SIGNIFICANT MAIN EFFECTS, g/mile			RANGE OF 800 VEHICLES	
	VEHICLE 802	VEHICLE 806	VEHICLE 809	MINIMUM	MAXIMUM
TIMING	3.600	3.474	4.185	1.110 *	4.185 *
IDLE RPM	—	—	-0.6650	-1.002 *	0.7525 *
PCV	—	—	—	-0.9687 *	0.2575 *
AIR CLN	—	—	—	-0.9687	-0.2850
IDLE CO	-1.661 *	—	0.4025 *	-1.661 *	0.4025 *
NO_X CONTROL	—	0.4294 *	1.806 *	0.3844 *	2.081 *
TOTAL SUMS OF SQUARES	123.3	107.7	202.5	16.70	202.5
MEAN SQUARE RESIDUAL	1.436	0.1317	0.2533	0.04186	1.436

* A DIFFERENCE OF 1.1 g/mile IS SIGNIFICANTLY DIFFERENT AT THE 90 PERCENT CONFIDENCE LEVEL.

For NO_x emissions all of the main effects, with the exception of air cleaner, showed significantly different effects between the nine test vehicles. For the three vehicles with identical drive train, timing was not significantly different. In contrast, the responses with Idle CO and NO_x control devices were significantly different. The fact that the anomolies occurred between Vehicles 802 and 809 suggests that the cause may lie in the differing experiments. In addition, Vehicle 802 had a large residual variance relative to the other two test vehicles, illustrating that its responses are less precisely defined. The responses to the NO_x control device for Vehicles 806 and 809 from a statistical standpoint are significantly different.

The results of the orthogonal experiments conducted with the 1971 Chevrolet vehicles with comparable drive trains indicates that the fundamental assumption made in the economic effectiveness study is valid. There was only one emission response in the three power trains which suggested that the assumption may not be valid.

3.6 TEST RESULTS AND CONCLUSIONS--COLD START PARAMETERS

Engine parameters which predominately affect cold start emissions were investigated as a part of the orthogonal experiment. Hydrocarbon, carbon monoxide and NO_x emission response coefficients were developed for two parameters. These were heat riser and choke vacuum kick. The vehicle fleets used for this analysis were the 700 series (Pre-emission Controlled Vehicles) and the 800 series (NO_x Controlled Vehicles) used in the previously described experiments. A total of six cold start tests were conducted on each vehicle to develop emission levels at three vacuum kick settings (-50 percent, normal and +50 percent) and two heat riser settings (normal and stuck open).

3.6.1 Analysis Approach

Individual analysis of variances of the data from the tests of each vehicle were first conducted separately. The results of this analysis, presented in Table 3.28, were not conclusive. The data used for the analysis are presented in Table 3.29. Although emission changes were frequently large, very few main effects could be shown to be significant (90 percent confidence level).

TABLE 3.28

RESULTS OF ANALYSIS OF VARIANCE CONDUCTED BY VEHICLE

COLD START PARAMETERS

VEHICLE NUMBER	MAKE	HC						CO						NO_x					
		VACUUM KICK, g/mile				HEAT RISER g/mile		VACUUM KICK, g/mile				HEAT RISER g/mile		VACUUM KICK, g/mile				HEAT RISER g/mile	
		-50%		+50%				-50%		+50%				-50%		+50%			
		LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN	LEVEL	SIGN
701	CHEVROLET 8	2.50	50	1.370	<50	0.410	<50	8.37	70	8.73	75	-1.737	50	-0.160	<50	-2.460	75	0.610	60
702	FORD 8	-0.860	75	-1.70	90	-0.093	<50	9.12	<50	-25.62	80	12.62*	85	-2.510	55	-4.420	75	-1.007*	55
703	DODGE 8	3.750	95	-0.820	75	1.643	95	34.85	60	-63.72	80	28.25	80	-1.500	95	4.970	99	-2.150	99
704	CHEVROLET 6	-3.50	55	-4.25	65	1.113	<50	-6.28	<50	-9.50	55	-6.24	70	-0.260	<50	-1.150	60	-0.043	<50
705	DODGE 6	0.830	60	-0.59	<50	-0.150	<50	8.63	75	-3.62	<50	-9.33	95	-0.110	<50	0.860	75	0.860	95
706	FORD 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
707	PONTIAC	14.62	60	-3.45	<50	5.280	55	168.1	70	-50.37	<50	54.2	60	-4.520	90	3.30	80	-0.813	65
708	OLDSMOBILE	-0.660	<50	-3.98	85	0.373	<50	-36.73	60	-70.90	80	-10.21	<50	-0.530	55	0.250	<50	-0.2267	55
801	DODGE	0.5800	95	0.1300	60	-0.0167	<50	18.95	85	-9.100	65	-2.213	<50	-0.3100	<50	0.5700	<50	-0.5767	70
802	CHEVROLET	-1.860	60	-0.4900	<50	-0.0533	<50	-6.610	60	-0.2500	<50	0.9267	<50	-1.020	<50	0.100	<50	1.787	70
803	MERCURY	0.880	<50	1.130	<50	-0.457	<50	24.28	75	10.58	<50	-8.567	70	-1.530	80	2.890	90	0.707	80
804	AMC	1.640	90	-0.2300	<50	-0.1833	50	47.47	95	-18.56	75	0.08333	<50	0.1600	<50	0.6200	50	-0.4833	80
805	FORD	2.330	>99	1.420	95	0.6733	95	49.40	90	5.310	<50	25.73	90	-1.290	<50	-1.130	50	0.4000	<50
806	CHEVROLET	0.710	85	0.210	50	-0.307	85	11.210	70	-2.200	<50	-7.507	80	-0.870	<50	-0.580	<50	-0.203	<50
807	PONTIAC	0.770	90	-0.220	50	-0.600	95	13.50	60	-25.15	80	-7.63	70	0.96	55	0.57	<50	0.9467	85
808	TOYOTA	0.710	>99	0.550	>99	-0.370	>99	23.910	90	3.200	<50	-0.403	<50	-1.000	60	-0.870	55	-0.317	55
809	CHEVROLET	0.900	55	0.6800	<50	0.0667	<50	4.710	<50	1.770	<50	-4.790	65	0.000	-	0.3400	<50	1.057	90

*SLOPE BASED ON CHANGE FROM NOMINAL.

TABLE 3.29

COLD START PARAMETER RAW TEST DATA

Vehicle No	Vacuum Kick Heat Riser	HC, g/mile			CO, g/mile			NO_x, g/mile		
		-50	Nominal	+50	-50	Nominal	+50	-50	Nominal	+50
701	Operational	6.62	5.27	7.85	101.3	93.7	101.2	4.44	3.94	3.55
701	Stuck Open	8.16	7.01	5.80	97.1	96.3	97.6	4.83	5.50	3.43
702	Operational	5.36	5.58	4.57	62.6	56.5	37.2	11.96	13.70	9.78
702	Stuck Open	4.88	5.52	4.83	43.6	40.5	34.2	10.46	11.23	10.73
703	Operational	7.08	5.48	5.10	99.2	60.4	41.5	7.70	8.36	11.07
703	Stuck Open	9.11	6.96	6.52	107.6	111.5	66.7	5.58	6.42	8.68
704	Operational	10.98	13.98	9.47	105.2	107.5	97.2	3.31	2.82	2.89
704	Stuck Open	12.17	12.67	12.93	94.1	98.1	98.9	2.87	3.62	2.40
705	Operational	6.23	5.53	5.76	91.6	89.1	89.0	3.14	3.32	3.41
705	Stuck Open	6.05	5.92	5.10	85.8	79.7	76.2	3.94	3.87	4.64
706	Operational	No Cold Start Parameter Tests								
706	Stuck Open									
707	Operational	7.09	7.83	6.27	109.3	103.7	68.5	3.31	6.52	7.34
707	Stuck Open	7.46(23.3)*	7.82	5.93	104.1(261.5)*	98.9	83.8	3.21	4.52	7.00
708	Operational	8.16	7.44	6.36	121.7	117.4	90.2	2.31	2.56	3.01
708	Stuck Open	7.74	9.12	6.22	86.8	127.8	84.1	2.28	2.56	2.36
801	Operational	3.08	2.71	2.81	56.21	43.48	43.69	4.65	4.72	4.45
801	Stuck Open	2.98	2.77	2.80	52.83	46.61	37.30	3.59	3.83	4.67
802	Operational	1.74	3.72	2.52	18.71	25.30	21.70	3.06	3.35	5.30
802	Stuck Open	2.45	2.33	3.04	21.70	21.72	25.07	5.82	6.55	4.70
803	Operational	3.35	2.24	3.87	42.34	21.37	27.35	4.97	5.22	7.07
803	Stuck Open	2.71	2.94	2.44	22.46	19.15	23.75	5.26	6.54	7.58
804	Operational	2.78	1.90	1.49	5.63	26.76	18.82	4.12	3.71	4.28
804	Stuck Open	2.32	1.56	1.74	49.76	31.16	20.54	3.37	3.62	3.67
805	Operational	3.65	2.55	3.35	67.39	35.37	33.66	4.18	5.83	4.47
805	Stuck Open	4.47	3.24	3.86	80.45	63.07	70.09	5.39	5.03	5.26
806-B	Operational	2.42	2.09	2.35	32.78	21.51	22.54	3.86	5.02	4.08
806-B	Stuck Open	2.25	1.87	1.82	19.14	19.20	15.97	4.19	3.90	4.26
807	Operational	3.29	2.89	2.63	52.66	40.45	25.22	4.17	3.99	3.59
807	Stuck Open	2.57	2.20	2.24	35.98	34.69	24.77	5.06	4.28	5.25
808	Operational	3.54	3.19	3.47	49.84	37.17	35.63	5.42	5.35	5.30
808	Stuck Open	3.18	2.82	3.09	46.39	35.15	39.89	4.60	5.67	4.85
809	Operational	2.42	2.63	2.66	21.68	25.43	22.13	4.62	5.14	5.04
809	Stuck Open	3.16	2.05	2.70	22.28	13.76	18.83	6.19	5.67	6.11

*Original data in brackets considered invalid and were replaced by the average emission for the vehicle.

Out of a total of 72 responses in the 700 series vehicles, only 8 were statistically significant at the 90 percent confidence level. Most often affected were the NO_x responses to the choke settings. With the NO_x controlled, 800 series vehicles only 15 of 81 responses were statistically significant. HC emission responses of the NO_x controlled vehicles were most often affected--a rich choke blade setting (vacuum kick -50%) resulting in an 0.6 to 2.3 gm/mile increase. Curiously, but consistently, the three similar Chevrolet power trains had no cases of statistical significance, although their emission levels generally fell in the range of the statistically significant vehicles. The heat riser malfunction generally had a much smaller impact on HC emissions and, therefore, tended not to have statistically significant responses over the change investigated. Rich choke blade settings in those cases in which the responses were statistically significant had marked influences on CO mass emissions--values ranged from 24 to 50 gm/mile. The responses of CO and HC emissions to this maladjustment tended to be nonlinear. The +50% malfunction (lean air fuel mixture) caused changes in emission 5 to 10 times the effects which resulted with a -50% malfunction.

The large variability in emissions associated with cold start is undoubtedly the major contributor to the low number of statistically significant responses. This influence is further compounded by the test procedure, wherein the cold start tests were dispersed within the larger orthogonal test matrix. Thus, the random influences of accumulated mileage under differing malfunctions contributed to the overall emission measurement variability. It should be noted, however, that the vehicles were always returned to specification prior to these tests and the previously discussed stability tests, and thus maintenance state was controlled to the degree possible.

In an attempt to derive more meaningful results, all of the emissions data were pooled and a second series of analysis of variances were performed. Vehicle control type and vehicle number were also used as variables in the analysis to determine their corresponding levels of significance. The primary objective of the analysis of variance, however, was to inspect for significance of the main effects, e.g., ±50 percent vacuum kick position versus the normal and failed heat riser valve and their two factor interactions.

The significance of each main effect or interaction was determined from the standard "F" test of the ratio of the sums of square variance and residual variance. A level of 90 percent or greater was considered statistically significant for all tests. The statistically significant main effects and interactions were further analyzed using Duncan's multiple range test*to partition vehicles into similar emission response sets. For those vehicle sets shown not to be statistically different, the responses were averaged to obtain a best estimate. The above approach is discussed in more detail below.

3.6.2 Discussion of Results

As previously described, the first step in the analysis with all of the test data combined was to statistically verify that the data from the two emission control fleets were different. To make this comparison, the emission response data were first normalized. The data for each vehicle was normalized by subtracting the emission level measured during the tests with the vehicle set to manufacturer's specification from the emissions measured during tests with simulated malfunctions. The normalized data are presented in Table 3.30. An analysis of variance conducted on the normalized data revealed that the two fleets were statistically different for each emission specie and, therefore, should be treated independently.

The analysis of variance with the fleets treated independently showed improvement in the statistical power of the test from the separate analyses conducted with data from each individual vehicle. A careful review, however, of the individual vehicle emission data indicated that within each emission specie either a given vehicle or subset of vehicles were statistically different from the other vehicles in the set. It was hypothesized that some of the main effects were masked by these extreme data. Analysis of variance was therefore rerun with select vehicles eliminated.

These results, presented in Table 3.31, show that the parameter malfunction effects are statistically significant for all emissions with the exception of two cases involving heat riser malfunction for hydrocarbon emission with pre-emission controlled vehicles and NO_x emissions with NO_x emission controlled vehicles. In addition, no two factor interactions (1-2)

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*Duncan's method is described in Reference 1.

TABLE 3.30

COLD START PARAMETER NORMALIZED TEST DATA

Vehicle No	Vacuum Kick Heat Riser	HC, g/mile -50	HC, g/mile Nominal	HC, g/mile +50	CO, g/mile -50	CO, g/mile Nominal	CO, g/mile +50	NO$_x$, g/mile -50	NO$_x$, g/mile Nominal	NO$_x$, g/mile +50
701	Operational	1.35	0	2.58	7.62	0	7.48	.50	0	-.39
701	Stuck Open	2.89	[illegible]	.53	3.38	2.63	3.80	.89	1.56	-.51
702	Operational	-.22	0	-1.01	6.06	0	19.34	-1.74	0	-4.00
702	Stuck Open	-.70	-.06	-.75	-12.91	-15.97	-22.25	-3.24	-2.47	-2.97
703	Operational	1.60	0	-.38	38.82	0	-18.85	-.66	0	2.71
703	Stuck Open	3.63	1.48	1.04	7.04	51.01	6.14	-2.78	-1.94	.32
704	Operational	-3.00	0	-2.84	-2.34	0	-16.30	.49	0	1.05
704	Stuck Open	-1.81	-1.31	-1.05	-13.38	-9.42	-8.59	.05	.80	-.42
705	Operational	.70	0	.23	2.53	0	-.13	-.18	0	.09
705	Stuck Open	.52	.39	-.43	-3.30	-9.40	-12.89	.62	.55	1.32
706	Operational				No Cold Start Parameter Tests					
706	Stuck Open									
707	Operational	-.74	0	-1.56	5.56	0	-36.24	-3.21	0	.83
707	Stuck Open	-.37	-.01	-1.90	.37	-4.82	-19.95	-3.31	-2.00	.48
708	Operational	.72	0	-1.08	4.27	0	-27.19	-.25	0	.45
708	Stuck Open	.30	1.68	-1.22	-30.61	10.39	-33.32	-.28	0	-.20
801	Operational	.37	0	1.00	12.73	0	.21	-.07	0	-.27
801	Stuck Open	.27	.06	.09	9.35	3.13	-6.18	-1.13	-.89	-.05
802	Operational	-1.98	0	-1.20	36.59	0	-3.60	-.29	0	1.95
802	Stuck Open	-1.27	-1.39	-.68	-3.60	-3.58	-.23	2.47	3.20	1.35
803	Operational	1.11	0	1.63	20.97	0	5.98	-.25	0	1.85
803	Stuck Open	.47	.70	.20	1.08	-2.22	2.38	.04	1.32	2.36
804	Operational	0.88	0	-.41	28.87	0	-7.94	.41	0	.57
804	Stuck Open	0.42	-.34	-.61	23.00	4.40	-6.22	-.34	-.09	-.04
805	Operational	1.10	0	.80	32.02	0	-1.71	-1.65	0	-1.36
805	Stuck Open	1.92	.69	1.31	45.08	27.70	34.72	-.44	-.80	-.57
806-B	Operational	.33	0	.26	11.27	0	1.03	-1.16	0	-.94
806-B	Stuck Open	.16	-.22	-.27	-2.37	-2.31	-5.54	-.83	-1.12	-.76
807	Operational	.40	0	-.26	12.21	0	-15.23	.18	0	-.40
807	Stuck Open	-.32	-.69	-.65	-4.47	-5.76	-15.68	1.07	.29	1.26
808	Operational	.35	0	.28	12.67	0	-1.54	.07	0	-.05
808	Stuck Open	-.01	-.37	-.10	9.22	-2.02	2.72	-.75	.32	-.50
809	Operational	-.21	0	.03	-3.75	0	-3.30	-.52	0	-.10
809	Stuck Open	.53	-.58	.07	-3.15	-11.67	-6.60	1.05	.53	.97

TABLE 3.31

COLD START PARAMETER

ANALYSIS OF VARIANCE RESULTS
1972 Federal Procedure

FLEET	ANALYSIS VARIABLE	HYDROCARBON		CARBON MONOXIDE		NO_X	
		SIGNIFICANCE (%)	D.F.	SIGNIFICANCE (%)	D.F.	SIGNIFICANCE (%)	D.F.
1 (700 Series) (Pre-Emission Controlled Vehicles)	1. Heat Riser	75	1	95	1	90	1
	2. Vacuum Kick	99	2	95	2	99	2
	3. Vehicle	99	5	75	5	95	5
	4. 1-2 Interaction	75	2	50	2	<50	2
	5. 1-3 Interaction	50	5	75	5	99	5
	6. 2-3 Interaction	75	10	75	10	99	10
2 (800 Series) (NO_x Emission Controlled Vehicles)	1. Heat Riser	90	1	99	1	75	1
	2. Vacuum Kick	99	2	99	2	90	2
	3. Vehicle	99	7	99	6	99	7
	4. 1-2 Interaction	<50	2	75	2	50	2
	5. 1-3 Interaction	75	7	50	6	95	7
	6. 2-3 Interaction	<50	14	75	12	75	14

of heat riser and vacuum kick were found to be significant and, hence the parameter malfunction emission responses were concluded to be pure main effects. The most salient result of the analysis, however, was that vehicle was a significant variable in all but one case (pre-emission controlled, carbon monoxide emission).

The final step of the analysis was to partition the responses into similar groups. In addition to those vehicles that were partitioned before the final analysis of variance, further grouping of the vehicles was accomplished by using Duncan's Multiple Range Test. This test provides a method for simultaneously comparing all the individual means of a given set of data and grouping the means into similar subsets.

The application of Duncan's test was done in two steps. The first step was to determine if either of the extreme levels, i.e., +50% or -50%, of the three level main effect in vacuum kick were significantly different. For those cases in which either the +50% or -50% deviations were different, the responses were separated by vehicle number. In a similar manner, the statistically significant responses, i.e., average differences between emissions with heat riser normal and closed, were partitioned by applying Duncan's test. A summary of the final vehicle subsets is presented in Table 3.32 for the significant main effects.

Finally, the normalized response coefficients for the significant main effects of each vehicle grouping were developed by determining the ratio of average change in emission level to the change in parameter level, both relative to specification. In the case of heat riser the parameter change was assigned the value of unity. The selection of the appropriate emission values to be used for this calculation was determined by the partitioning described above and resulted in the choice of one of the following: 1) average the responses of all vehicles used in the analysis, 2) average the responses of pooled vehicles with statistically similar emission levels or 3) response of a single vehicle when shown to be statistically different. The nonsignificant main effects were assigned the value of zero.

TABLE 3.32

SUMMARY OF VEHICLES WITH STATISTICALLY SIMILAR RESPONSES

FLEET	EMISSION SPECIE	COLD START PARAMETER	VEHICLE SUBSETS (ENCLOSED IN PARENTHESES)
Pre Emission Controlled	Hydrocarbon	Vacuum Kick (-50%)	(701, 702, 703, 705, 707, 708), (704)
		Vacuum Kick (+50%)	(701), (704), (703, 705), (702, 707, 708)
	Carbon Monoxide	Vehicle Effect not Significant	(703), (701, 702, 704, 705, 707, 708)
	NO_x	Vacuum Kick (-50%)	(701, 704, 705, 708), (703), (702), (707)
		Vacuum Kick (+50%)	(703), (704, 705, 707, 708), (701), (702)
		Heat Riser	(701, 705), (704, 707, 708), (703), (702)
NO_x Emission Controlled	Hydrocarbon	Vacuum Kick (-50%)	(805), (802), (803, 804), (801, 806, 808, 809), (807)
		Vacuum Kick (-50%)	(801, 803, 804, 805, 806, 807, 808, 809)
		Heat Riser	(805), (801, 803, 804, 807, 808, 809), (802)
	Carbon Monoxide	Vacuum Kick (-50%)	(801, 803, 808), (806, 807), (805), (804), (802, 809)
		Vacuum Kick (+50%)	(801, 802, 803, 806, 807, 808, 809) (805), (804)
		Heat Riser	(804), (805), (801, 802, 803, 806, 807, 808, 809)
	NO_x	Vacuum Kick (-50%)	(801, 803, 804, 805, 806, 807, 808, 809), (802)
		Vacuum Kick (+50%)	(802), (801, 803, 804, 805, 806, 807, 808, 809)

Parentheses indicate vehicles with similar statistically significant responses

The response coefficients of each of the significant main effects for both the precontrolled and the NO_x controlled fleets are shown in Tables 3.33 through 3.38.

The following significant conclusions are indicated:

- The vehicles in either fleet did not usually group by manufacturer nor were the groupings always consistent across the three emission species.
- The generally larger response of the -50% malfunction (lean setting) than the +50% malfunctions (rich setting) indicated a nonlinear effect. For the pre-emission controlled vehicles, the converse was true.
- The emission responses tended to vary both in sign and magnitude for both HC and CO, but NO_x responses tended to be positive with increased leanness.
- The older pre-emission controlled vehicles have greater CO and HC emission sensitivities to choke parameter malfunctions than do the NO_x controlled vehicles.
- The variability of the emissions data is large relative to the previously described "hot" parameter orthogonal experiments, producing low levels of significance.

The wide diversity of power trains selected for these experiments should result in different emission responses to the "cold start" parameters. This was indeed experienced in the hot parameter experiments and again verified with these experiments. Two of the three similar GM power trains, vehicles 806 and 809, had similar responses in all emissions except CO. The GM vehicle 802 had emission responses of identical sign (except CO at the rich choke blade setting) which were generally twice as large as the two other vehicles.

The choke blade settings produced anomalous results on pre-emission controlled CO emissions. On all but one vehicle (703), small CO emissions decreases of about .010 gm/mile/% were estimated with increased choke closure. It is significant to note that this conclusion was reached by pooling all of the data except vehicle 703. Repair of heat riser malfunction of pre-emission controlled vehicles caused increases in CO emission. Correspondingly smaller CO emission increases resulted with NO_x controlled vehicles. NO_x emissions changes (gm/mile) were substantially smaller and usually of the same sign as CO changes.

TABLE 3.33
SUMMARY OF POOLED HC EMISSION RESPONSE COEFFICIENTS
PRE-EMISSION CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 Federal Procedure

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING) -50% g/mile/%	VACUUM KICK (BLADE SETTING) +50% g/mile/%	HEAT RISER g/mile
CHEVROLET 8	701	-7.440E-03	1.570E-02	0.0
FORD 8	702	-7.440E-03	-3.042E-02	0.0
DODGE 8	703	-7.440E-03	-7.050E-03	0.0
CHEVROLET 6	704*	3.500E-02	-2.480E-02	0.0
DODGE 6	705	-7.440E-03	-7.050E-03	0.0
PONTIAC 8	707	-7.440E-03	-3.042E-02	0.0
OLDSMOBILE 8**	708	-7.440E-03	-3.042E-02	0.0

---

*Emission data statistically and systematically different from other data and therefore were not included in the analysis of variance sample. Coefficients are based on individual test results.

**Bimetal spring index varied rich and lean of specification--no blade setting adjustment.

TABLE 3.34
SUMMARY OF POOLED CO EMISSION RESPONSE COEFFICIENTS PRE-EMISSION CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 Federal Procedure

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING)		HEAT RISER
		-50% g/mile/%	+50% g/mile/%	g/mile
CHEVROLET 8	701	1.026E-02	1.994E-01	-8.161 E00
FORD 8	702	1.026E-02	1.994E-01	-8.161 E00
DODGE 8	703*	-3.485E-01	-6.372E-01	28.073 E00
CHEVROLET 6	704	1.026E-02	1.994E-01	-8.161 E00
DODGE 6	705	1.026E-02	1.994E-01	-8.161 E00
PONTIAC 8**	707	1.026E-02	1.994E-01	-8.161 E00
OLDSMOBILE 8	708	1.026E-02	1.994E-01	-8.161 E00

---

*Emission data statistically and systematically different from other data and therefore were not included in the analysis of variance sample. Coefficients are based on individual test results.

**Bimetal spring index varied rich and lean of specification--no blade setting adjustment.

TABLE 3.35

SUMMARY OF POOLED NO_X EMISSION RESPONSE COEFFICIENTS
PRE-EMISSION CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 FEDERAL PROCEDURE

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING) -50% g/mile/%	VACUUM KICK (BLADE SETTING) +50% g/mile/%	HEAT RISER g/mile
CHEVROLET 8	701	3.600E-04	-2.460E-02	7.350E-01
FORD 8	702*	2.510E-02	-4.500E-02	-9.800E-01
DODGE 8	703	1.500E-02	4.970E-02	-2.150E 00
CHEVROLET 6	704	3.600E-04	1.062E-02	-4.710E-01
DODGE 6	705	3.600E-04	1.062E-02	7.350E-01
PONTIAC 8**	707	4.520E-02	1.062E-02	-4.710E-01
OLDSMOBILE 8	708	3.600E-04	1.062E-02	-4.710E-01

*EMISSION DATA STATISTICALLY AND SYSTEMATICALLY DIFFERENT FROM OTHER DATA AND THEREFORE WERE NOT INCLUDED IN THE ANALYSIS OF VARIANCE SAMPLE. COEFFICIENTS ARE BASED ON INDIVIDUAL TEST RESULTS.

TABLE 3.36

SUMMARY OF POOLED HC EMISSION RESPONSE COEFFICIENTS
NO_X CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 FEDERAL PROCEDURE

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING)		HEAT RISER
		- 50% g/mile/%	+50% g/mile/%	g/mile
DODGE	801	-7.160E-03	5.701E-03	-3.100E-01
CHEVROLET	802*	-1.860E-02	-4.900E-03	-5.333E-02
MERCURY	803	-1.276E-02	5.701E-03	-3.100E-01
AMC 6**	804	-1.276E-02	5.701E-03	-3.100E-01
FORD	805	-2.330E-02	5.701E-03	6.733E-01
CHEVROLET	806	-7.160E-03	5.701E-03	-3.100E-01
PONTIAC	807	-7.700E-03	5.701E-03	-3.100E-01
TOYOTA 4	808	-7.160E-03	5.701E-03	-3.100E-01
CHEVROLET	809	-7.160E-03	5.701E-03	-3.100E-01

*EMISSION DATA STATISTICALLY AND SYSTEMATICALLY DIFFERENT FROM OTHER DATA AND THEREFORE WERE NOT INCLUDED IN THE ANALYSIS OF VARIANCE SAMPLE. COEFFICIENTS ARE BASED ON INDIVIDUAL TEST RESULTS.

TABLE 3.37

SUMMARY OF POOLED CO EMISSION RESPONSE COEFFICIENTS
NOX CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 FEDERAL PROCEDURE

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING)		HEAT RISER
		-50% g/mile/%	+50% g/mile/%	g/mile
DODGE	801	-2.163E-01	-3.022E-02	-4.313 E00
CHEVROLET	802	9.200E-03	-3.022E-02	-4.313 E00
MERCURY	803	-2.163E-01	-3.022E-02	-4.313 E00
AMC	804*	4.940E-01	5.310E-02	25.730 E00
FORD	805*	4.747E-01	-1.856E-01	8.333 E02
CHEVROLET	806	-8.360E-02	-3.022E-02	-4.313 E00
PONTIAC	807	-8.360E-02	-3.022E-02	-4.313 E00
TOYOTA	808	-2.163E-01	-3.022E-02	-4.313 E00
CHEVROLET	809	9.200E-03	-3.022E-02	-4.313 E00

*EMISSION DATA STATISTICALLY AND SYSTEMATICALLY DIFFERENT FROM OTHER DATA AND THEREFORE WERE NOT INCLUDED IN THE ANALYSIS OF VARIANCE SAMPLE. COEFFICIENTS ARE BASED ON INDIVIDUAL TEST RESULTS.

TABLE 3.38

SUMMARY OF POOLED NO_X EMISSION RESPONSE COEFFICIENTS
NOX CONTROLLED VEHICLE COLD START PARAMETER TESTS
1972 FEDERAL PROCEDURE

MAKE	VEHICLE NUMBER	VACUUM KICK (BLADE SETTING)		HEAT RISER
		-50% g/mile/%	+50% g/mile/%	g/mile
DODGE	801	4.850E-03	3.012E-03	0.0
CHEVROLET *	802*	1.020E-02	1.000E-03	0.0
MERCURY	803	4.850E-03	3.012E-03	0.0
AMC**	804	4.850E-03	3.012E-03	0.0
FORD	805	4.850E-03	3.012E-03	0.0
CHEVROLET	806	4.850E-03	3.012E-03	0.0
PONTIAC	807	4.850E-03	3.012E-03	0.0
TOYOTA	808	4.850E-03	3.102E-03	0.0
CHEVROLET	809	4.850E-03	3.012E-03	0.0

*EMISSION DATA STATISTICALLY AND SYSTEMATICALLY DIFFERENT FROM OTHER DATA AND THEREFORE WERE NOT INCLUDED IN THE ANALYSIS OF VARIANCE SAMPLE. COEFFICIENTS ARE BASED ON INDIVIDUAL TEST RESULTS.

NO_x controlled vehicle HC and CO emissions almost always decreased with carburetor leaning of those choke parameters, on the rich side of specification. There are two significant exceptions with regard to CO, vehicles 804 and 805. Both vehicles had positive responses of approximately 0.5 gm/mile/% and 8 to 25 gm/mile for choke blade setting and heat riser, respectively. GM vehicles 802 and 809 had essentially zero response to blade setting. With these stated exceptions, the remaining 800 series vehicles had CO emission responses which would result in reduction upon maintenance.

The superficial implications of the above discussion are that the heat riser exhaust valves tend not to be cost-effective to repair on all vehicles, but rich choke blade settings should only be adjusted on NO_x controlled vehicles. This maintenance program should be modestly effective in reducing CO and HC emissions and have a minimum, but increasing influence on NO_x.

A qualitative comparison of those vehicles with "hot start" emissions variability in the previously discussed orthogonal experiments did not indicate a strong correlation with those vehicles with "cold start" emissions variability. The data strongly suggest that an external, uncontrolled variable is affecting cold start emissions. This same phenomena was observed in the engine parameter deterioration experiment described in Section 2. This may be the result of large non-repeatabilities in other parts of the choke linkage (i.e., bimetal spring and vacuum pull-off) and in engine thermal state at both engine start and during warm-up.

4.0 DETROIT ENGINE PARAMETER SURVEY

An engine parameter survey is a detailed engine tune-up parameter diagnostic inspection for the purpose of establishing the state of emission related engine parameters of the vehicle population for any given region. The starting point in the Economic/Effectiveness model is the characterization of the state of engine tune-up parameters and the associated emission characteristics of the vehicles of a given region. Engine parameter surveys had been performed previously in the San Bernardino, California area--a 226 vehicle survey was performed in December of 1970 (Reference 10) and the first inspection of the 450 Vehicle Parameter Deterioration Survey Fleet of Section 2 of this report provided an additional survey. The San Bernardino surveys characterized the vehicle population of the Los Angeles (California South Coast) Basin.

In order to characterize the state of tune-up of vehicles in a different geographic and climatic area and with alternate emission control requirements than the previous San Bernardino studies, an engine parameter survey was performed in the Detroit metropolitan area. This survey was performed on 260 vehicles at the Scott Research Laboratories' facilities in Madison Heights, Michigan. The vehicles that were surveyed were representative of those in the Detroit metropolitan area. The state of engine tune-up related adjustments and components and keymode exhaust emissions were measured.

4.1 EXHAUST SAMPLE IDENTIFICATION AND ACQUISITION PROCEDURES

4.1.1 Vehicle Sample Identification

Two basic fleets of vehicles were selected for this survey; Fleet No. 1 was composed of 130 vehicles that had no exhaust emission controls and Fleet No. 2 included 130 vehicles with controls for hydrocarbon and carbon monoxide exhaust emissions. These fleets, with regard to emission control equipment, were comparable to Fleets 1 and 2 of the Parameter Deterioration Survey. However, since nation wide controls were implemented two years later than in California, the model years of the vehicles within the Detroit fleets were skewed by two years from the San Bernardino fleets.

The Detroit survey Fleet 1 covered vehicles from model years 1960 through 1967, and Fleet 2 contained model year vehicles 1968 through 1971. The percentage of vehicles were apportioned within each fleet to represent the national in-use distribution of make, model and year. Only Volkswagen was selected for representation of foreign makes. The fleet acquisition criteria and the required distribution of vehicles are listed by model and year is presented in Table 4.1. Since the availability of older vehicles was low in the Detroit area, 1963 and 1964 model year vehicles were occasionally selected in place of 1960 through 1962 model years.

The distributions of the two vehicle fleets, by make, are graphically presented in Figures 4.1 and 4.2. The histograms are shaded to indicate vehicles with automatic transmissions (shaded with lines of positive slope) and V-8 engines (shaded with lines of negative slope). The numerical value of the national fraction is also indicated. A comparison of the numerical values with the "y" ordinate indicates the degree to which the selected vehicle population agreed with the experimental design goals. The discrepancies between the actual fleet and the designed fleets are considered to be within the acceptable range.

4.1.2 Vehicle Acquisition

Vehicles for this program were initially identified by the returns of local distribution of questionnaires. These questionnaires were filled out by vehicle owners who were willing to participate in the program and provided basic information on their vehicles. Since the local area around the Scott facility was commercial in nature, the distribution of vehicle owners represented a broad coverage of the Detroit area. Owners of desired vehicles were contacted as needed in order to schedule their vehicles for testing. The vehicles were either delivered by their owners or picked-up by a Scott employee. A cash incentive of ten dollars was provided for the use of the owner's vehicle.

TABLE 4.1
ENGINE PARAMETER SURVEY

1.0 Require 260 Cars

1.1 130 Uncontrolled 1960-1967 (Fleet #1)

1.2 130 Controlled 1968-1971 (Fleet #2)

2.0 Based on percent of population for Task #1 the following fleets were composed:

	FLEET #1	FLEET #2
Buick	8	8
Cadillac	4	4
Chevrolet	35	29
Chrysler	3	4
Dodge	7	8
Ford	29	29
Mercury	6	6
Oldsmobile	9	9
Plymouth	8	10
Pontiac	11	11
Rambler	5	4
VW	5	8

3.0 The number of cars to be tested for each make/model/body size is tabulated as follows:

TABLE 4.1 (Cont'd)

VEHICLE MODEL DISTRIBUTION FOR TASK #4

<table>
<tr><th></th><th>'60</th><th>'61</th><th>'62</th><th>'63</th><th>'64</th><th>'65</th><th>'66</th><th>'67</th><th>'68</th><th>'69</th><th>'70</th><th>'71</th></tr>
<tr><td>BUICK</td><td colspan="4">(- - - 1 - - -)</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Std.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 5 - - -)</td><td colspan="4">(- - - 6 - - -)</td></tr>
<tr><td>Int.</td><td colspan="4"></td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 2 - - -)</td></tr>
<tr><td>Com.</td><td colspan="12"></td></tr>
<tr><td>CADILLAC</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 3 - - -)</td><td colspan="4">(- - - 4 - - -)</td></tr>
<tr><td>CHEVROLET</td><td>1</td><td>2</td><td>2</td><td>2</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>8</td></tr>
<tr><td>Std.</td><td>1</td><td>1</td><td>1</td><td>1</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td><td>3</td><td>4</td></tr>
<tr><td>Int.</td><td></td><td></td><td></td><td></td><td>2</td><td>2</td><td>2</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Com.</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CHRYSLER</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 4 - - -)</td></tr>
<tr><td>DODGE</td><td colspan="4">(- - - 2 - - -)</td><td>1</td><td>2</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Std.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 3 - - -)</td></tr>
<tr><td>Int.</td><td colspan="4"></td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 3 - - -)</td></tr>
<tr><td>Com.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 2 - - -)</td></tr>
<tr><td>FORD</td><td>1</td><td>1</td><td>1</td><td>2</td><td>6</td><td>6</td><td>6</td><td>6</td><td>7</td><td>7</td><td>8</td><td>7</td></tr>
<tr><td>Std.</td><td>1</td><td>1</td><td>1</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>4</td><td>3</td></tr>
<tr><td>Int.</td><td colspan="4">(- - - 2 - - -)</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Com.</td><td colspan="4">(- - - 2 - - -)</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>MERCURY</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 5 - - -)</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>OLDSMOBILE</td><td colspan="4">(- - - 2 - - -)</td><td>1</td><td>2</td><td>2</td><td>1</td><td>3</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Std.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 4 - - -)</td><td colspan="4">(- - - 6 - - -)</td></tr>
<tr><td>Int.</td><td colspan="4"></td><td colspan="4">(- - - 3 - - -)</td><td colspan="4">(- - - 3 - - -)</td></tr>
<tr><td>Com.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4"></td><td colspan="4"></td></tr>
<tr><td>PLYMOUTH</td><td colspan="4">(- - - 2 - - -)</td><td>1</td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>Std.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 4 - - -)</td><td colspan="4">(- - - 7 - - -)</td></tr>
<tr><td>Int.</td><td colspan="12"></td></tr>
<tr><td>Com.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 3 - - -)</td></tr>
<tr><td>PONTIAC</td><td colspan="4">(- - - 2 - - -)</td><td>2</td><td>2</td><td>3</td><td>2</td><td>3</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>Std.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 4 - - -)</td><td colspan="4">(- - - 5 - - -)</td></tr>
<tr><td>Int.</td><td colspan="4"></td><td colspan="4">(- - - 3 - - -)</td><td colspan="4">(- - - 4 - - -)</td></tr>
<tr><td>Com.</td><td colspan="4">(- - - 1 - - -)</td><td colspan="4">(- - - 2 - - -)</td><td colspan="4">(- - - 2 - - -)</td></tr>
<tr><td>RAMBLER</td><td colspan="4">(- - - 1 - - -)</td><td>1</td><td>1</td><td>1</td><td>1</td><td colspan="4">(- - - 4 - - -)</td></tr>
<tr><td>VW</td><td colspan="4">(- - - 1 - - -)</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
</table>

FIGURE 4.1

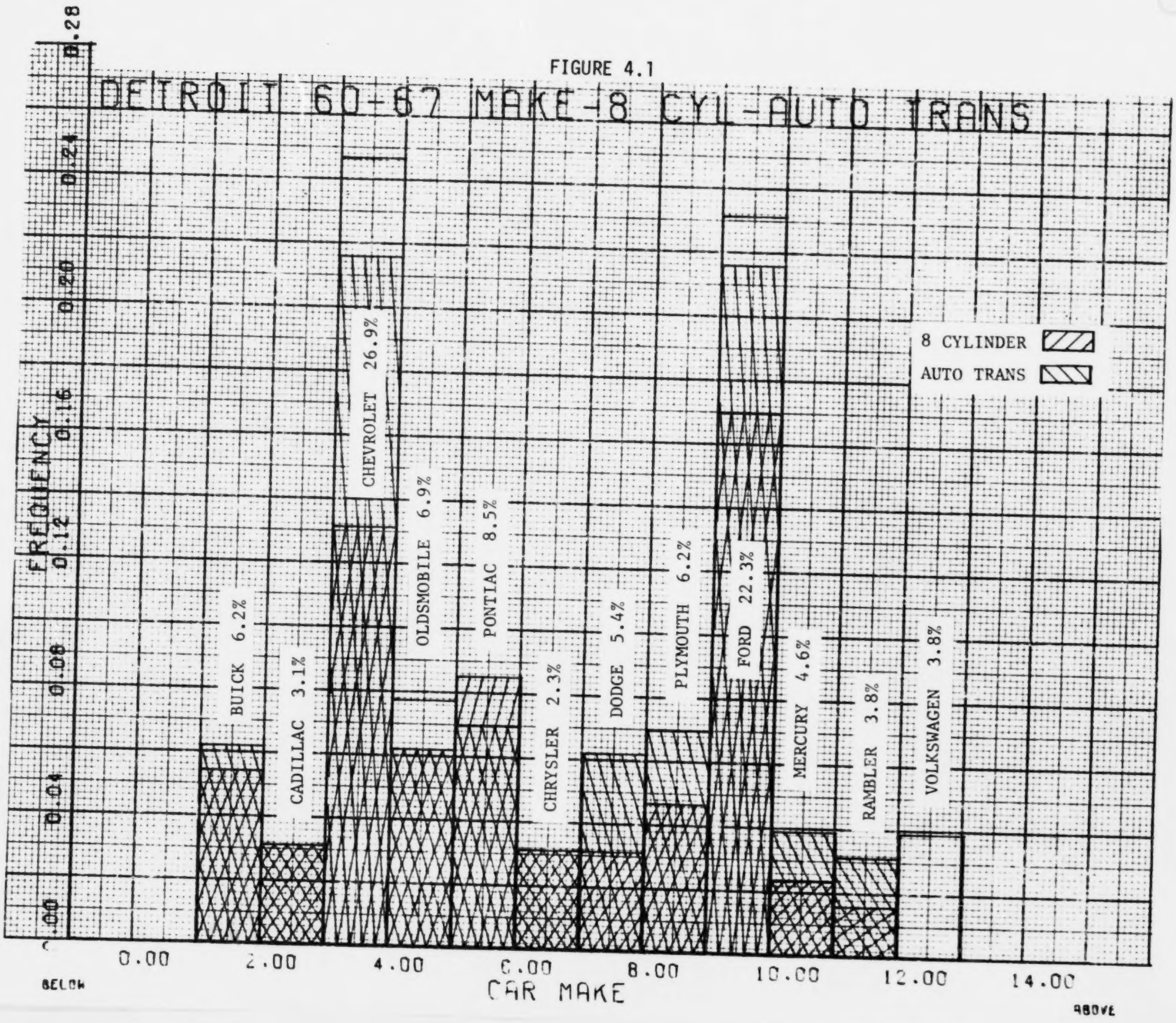
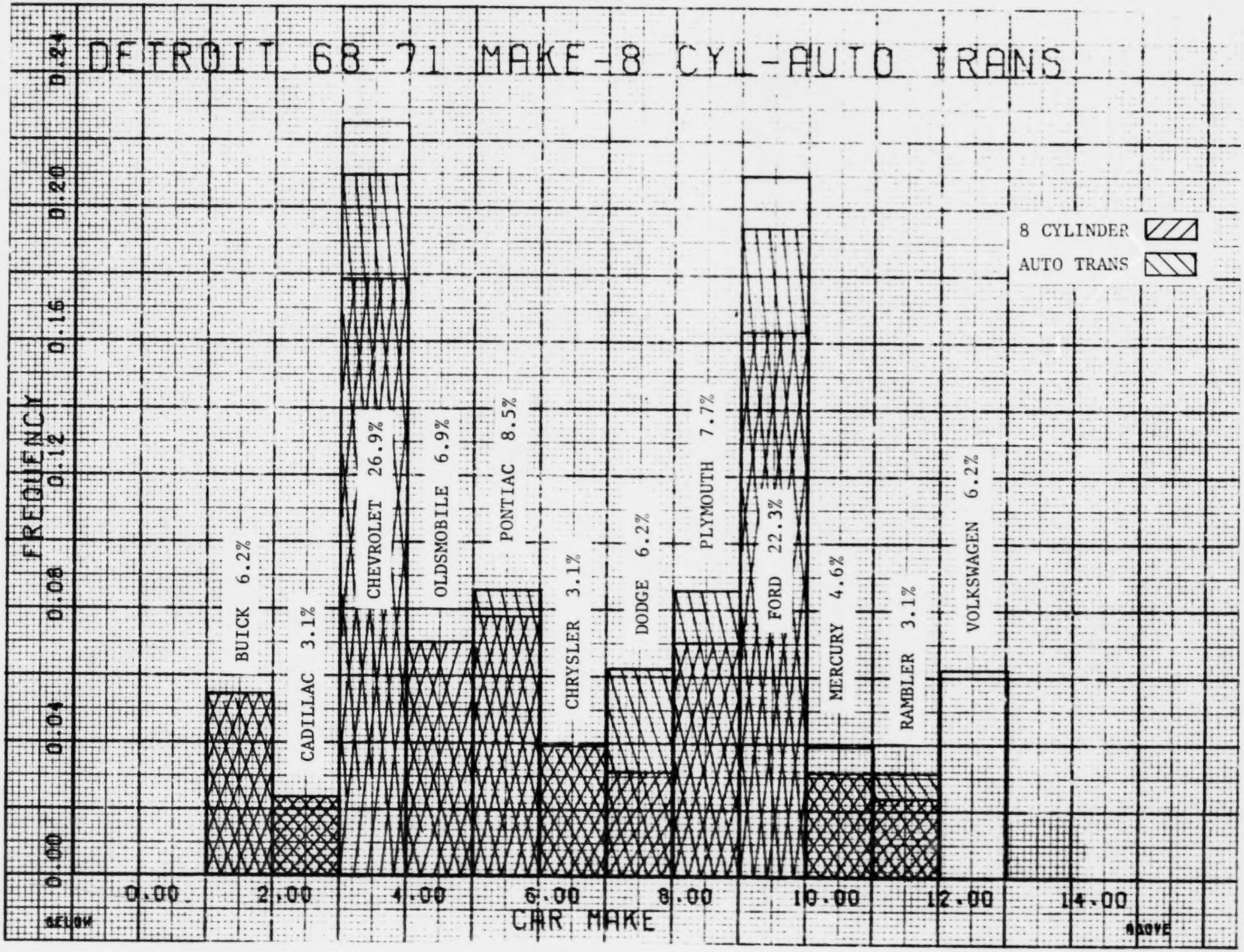

DETROIT 60-67 MAKE-8 CYL-AUTO TRANS
8 CYLINDER
AUTO TRANS
BUICK 6.2%
CADILLAC 3.1%
CHEVROLET 26.9%
OLDSMOBILE 6.9%
PONTIAC 8.5%
CHRYSLER 2.3%
DODGE 5.4%
PLYMOUTH 6.2%
FORD 22.3%
MERCURY 4.6%
RAMBLER 3.8%
VOLKSWAGEN 3.8%
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.28
CAR MAKE
BELOW
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
ABOVE

FIGURE 4.2


DETROIT 68-71 MAKE-8 CYL-AUTO TRANS
8 CYLINDER ▨
AUTO TRANS ▨
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
0.24
BUICK 6.2%
CADILLAC 3.1%
CHEVROLET 26.9%
OLDSMOBILE 6.9%
PONTIAC 8.5%
CHRYSLER 3.1%
DODGE 6.2%
PLYMOUTH 7.7%
FORD 22.3%
MERCURY 4.6%
RAMBLER 3.1%
VOLKSWAGEN 6.2%
BELOW
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
ABOVE
CAR MAKE

4.2 VEHICLE INSPECTION AND EMISSION TEST PROCEDURES

4.2.1 Engine Parameter Inspection

The procedures used for inspecting engine tune-up parameters were those used for the Parameter Deterioration Survey except for the addition of the measurement of the carburetor float level. Thses procedures are described in Section 2.2.1. The float level was measured in accordance with the manufacturers' procedures as described in the Service Manuals.

4.2.2 Emission Inspection

The vehicle emissions were measured during operation of the vehicle over the Clayton Keymode Cycles. The Keymode Cycles are described in Table 2.4 of Section 2.3.2. The emissions of Carbon Monoxide, NDIR Hydrocarbons, Carbon Dioxide and Nitric Oxide were monitored and recorded when a stable reading was obtained during the three keymodes--49/45 MPH Cruise, 33/30 MPH Cruise and Idle. The Keymode Cycle was performed with the engine in the warmed state and after the measurement of the static engine parameters.

4.3 INSTRUMENTATION AND TEST EQUIPMENT

With the exception of pressure and emission measurement equipment the test equipment was identical to the equipment used for the Parameter Deterioration Experiment (Section 2.4). Magnehelic gauges were used rather than manometers for crank case and air cleaner pressure measurements. A Magnehelic gauge with a range of ±2.0 inches of water was used for the measurement of the crankcase pressure and a gauge reading from 0 to 15 inches of water was used for the air cleaner pressure drop readings. The exhaust emissions were measured with a Scott Model 108-X analysis system. The full scale ranges of the instruments were 12 percent CO, 16 percent CO_2 and 10,000 ppm n-Hexane and 5000 ppm NO.

4.4 DATA ANALYSIS AND TEST RESULTS

The data management system developed in support of the deterioration experiment was used to process this data (See Section 2.5). Data analysis consisted primarily of developing the statistics on engine parameters and emissions and of analyzing the effectiveness of emission signatures in detecting engine malfunctions. This section presents the population distributions both graphically and statistically. The effectiveness of emission signatures in diagnosing malfunctions was previously reported in Section 2.6.3. All of the data taken as a part of this experiment are presented in tabular form in Appendix C. The listings include the estimates of the mean, standard deviation, degrees of freedom and "t" values. The discussion presented in this section is directed at those parameters which are considered to be important in controlling vehicle emissions.

The distributions of the emission and engine parameters can usually be approximated by either normal or log-normal distributions. To graphically illustrate the distributions, frequency diagrams which present the normalized frequency for a discrete range of a given parameter as a function of the absolute parameter values are presented. The HC emission measurements taken using the three Clayton keymodes, (i.e., 49/45 MPH Cruise, 33/30 MPH Cruise and Idle) shows in Figures 4.3 to 4.8 have a tendency toward skewedness. The distribution of CO is approximately log-normal, Figures 4.9 through 4.14. However, because of the ease in which the statistics can be handled, the statistical tests used in the following analysis assume a normal distribution.

The historgrams of typical engine parameters are presented to illustrate the normality of these distributions. Idle RPM, Figures 4.15 and 4.16, show a tendency toward a normal distribution. In contrast, Figure 4.17, timing of pre-emission controlled vehicles shows a fairly constant frequency distribution with no central tendency. The corresponding distribution of emission controlled vehicles appear approximately normal (Figures 4.18). Although the distribution for the PCV flow rate, as measured in the 49/45 MPH Cruise Mode, is non-continuous, it is apparent that the normal distribution is a reasonable approximation (Figures 4.19 and 4.20). The distribution of air cleaner angle measured in degrees can best be approximated with

FIGURE 4.3

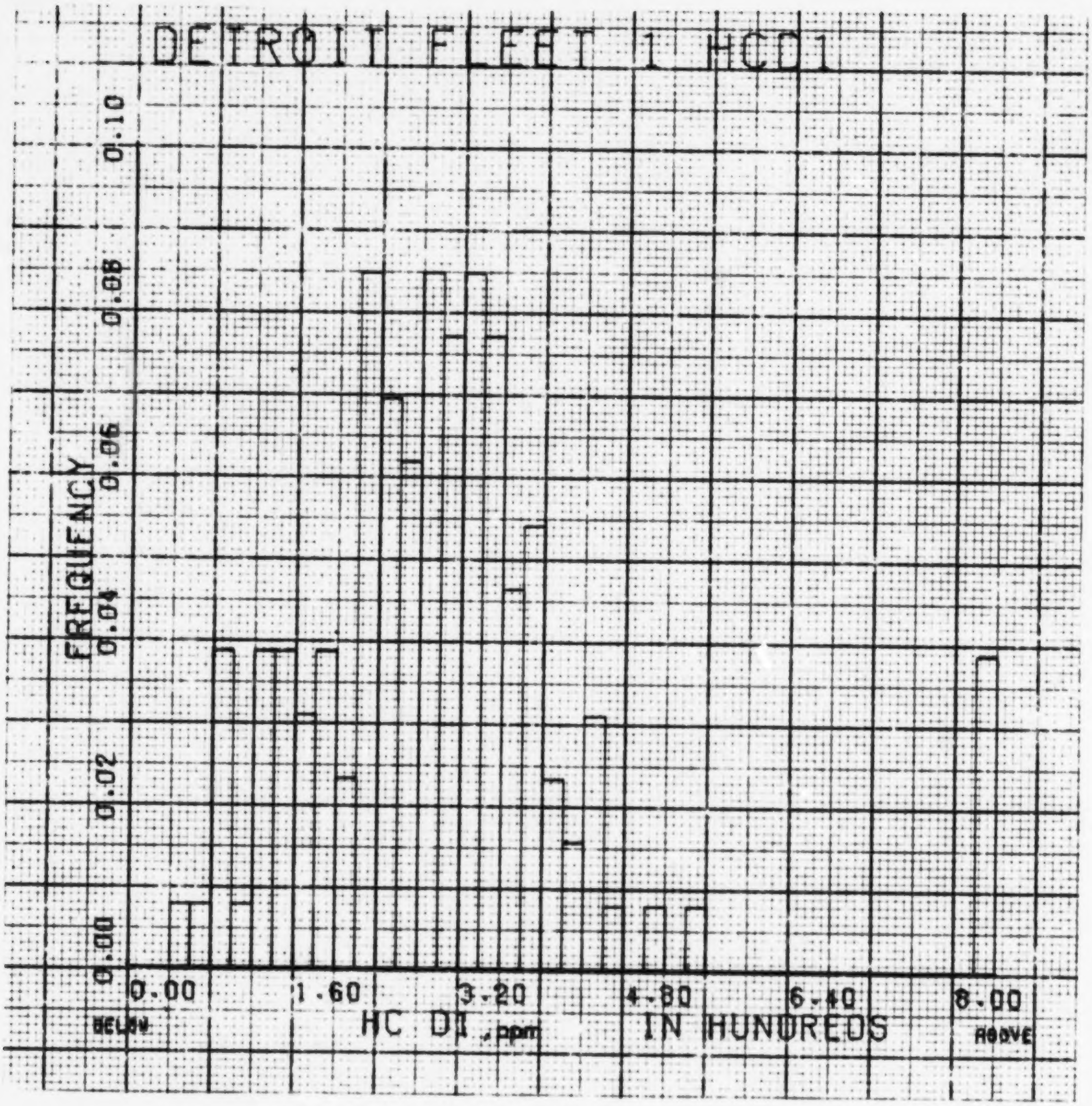

DETROIT FLEET 1 HCD1
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
HC DI, ppm IN HUNDREDS
ABOVE

FIGURE 4.4

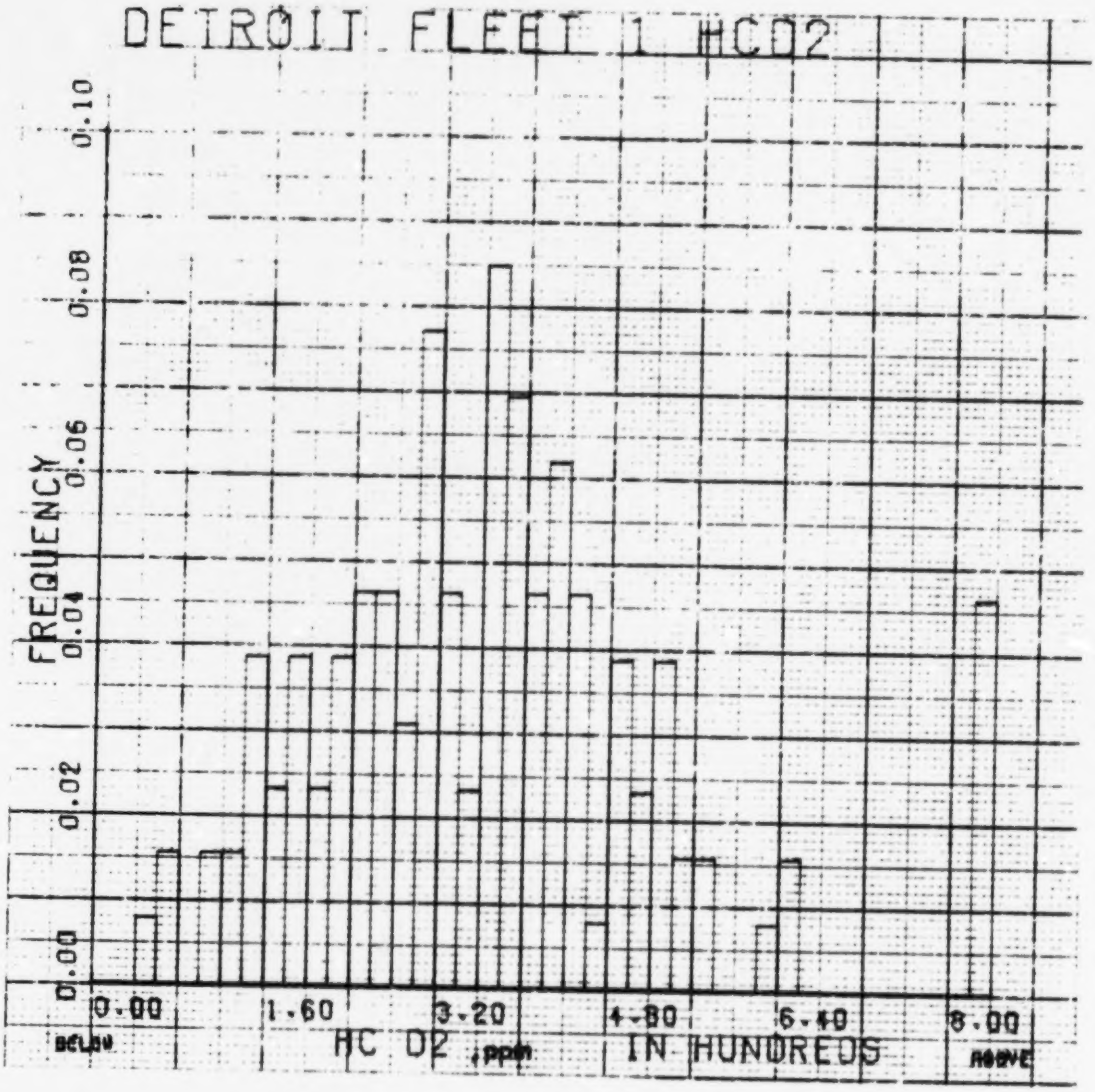

DETROIT FLEET 1 HCO2
FREQUENCY
0.10
0.08
0.06
0.04
0.02
0.00
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
ABOVE
HC O2 ,ppm IN HUNDREDS

FIGURE 4.5

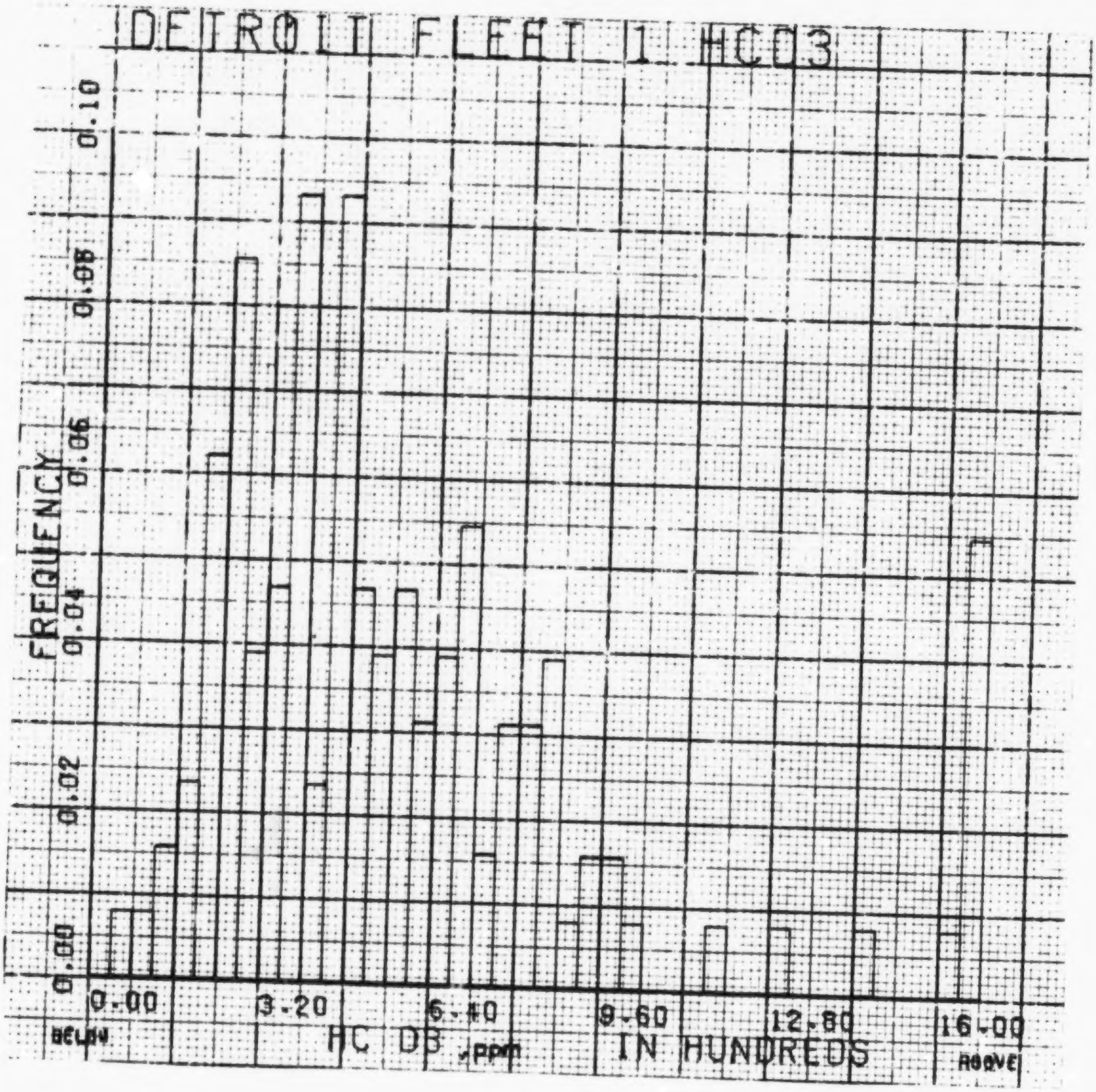

DETROIT FLEET 1 HC03
FREQUENCY
0.10
0.08
0.06
0.04
0.02
0.00
0.00
3.20
6.40
9.60
12.80
16.00
BELOW
ABOVE
HC D3 ,PPM
IN HUNDREDS

FIGURE 4.6

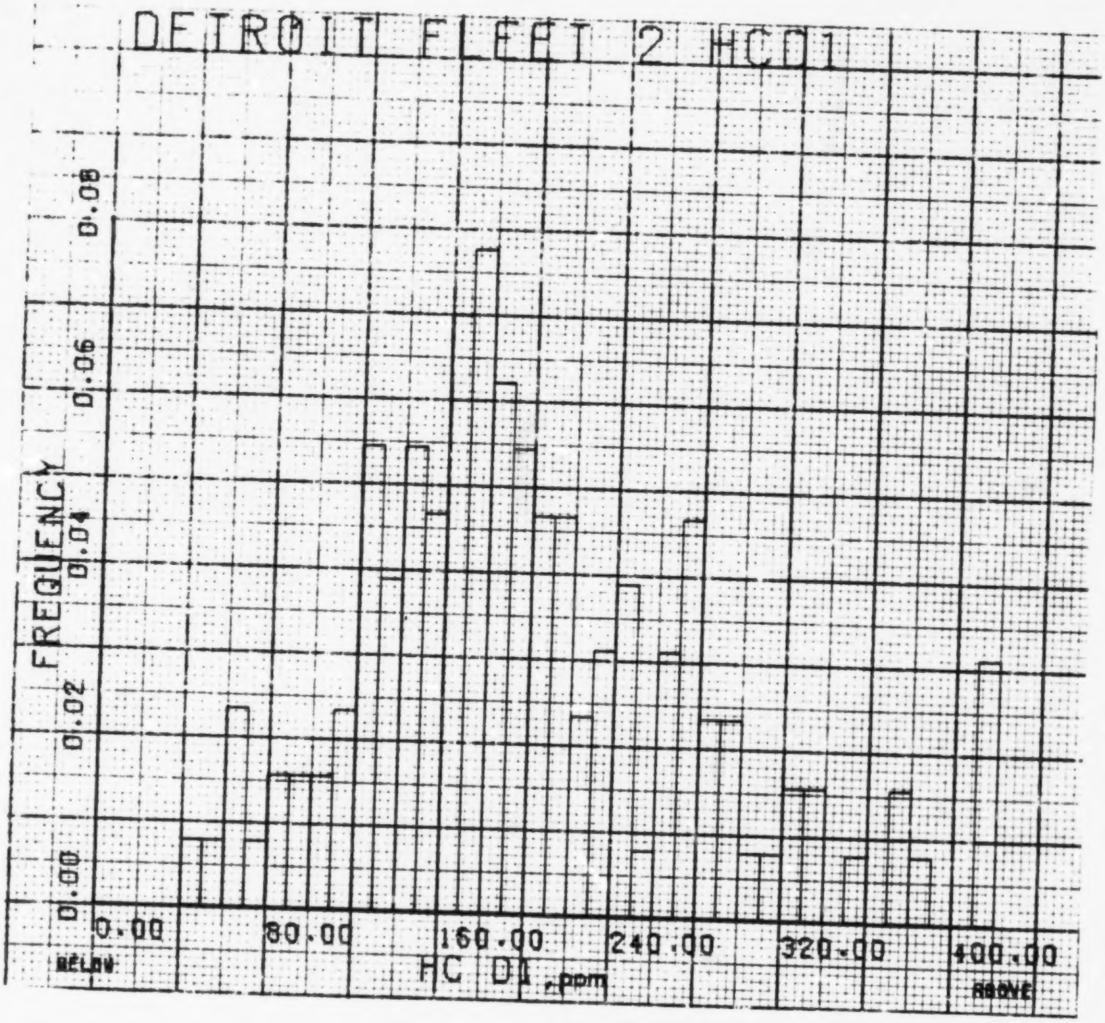

DETROIT FLEET 2 HCO1
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.00
80.00
160.00
240.00
320.00
400.00
BELOW
ABOVE
HC O1 ,ppm

FIGURE 4.7

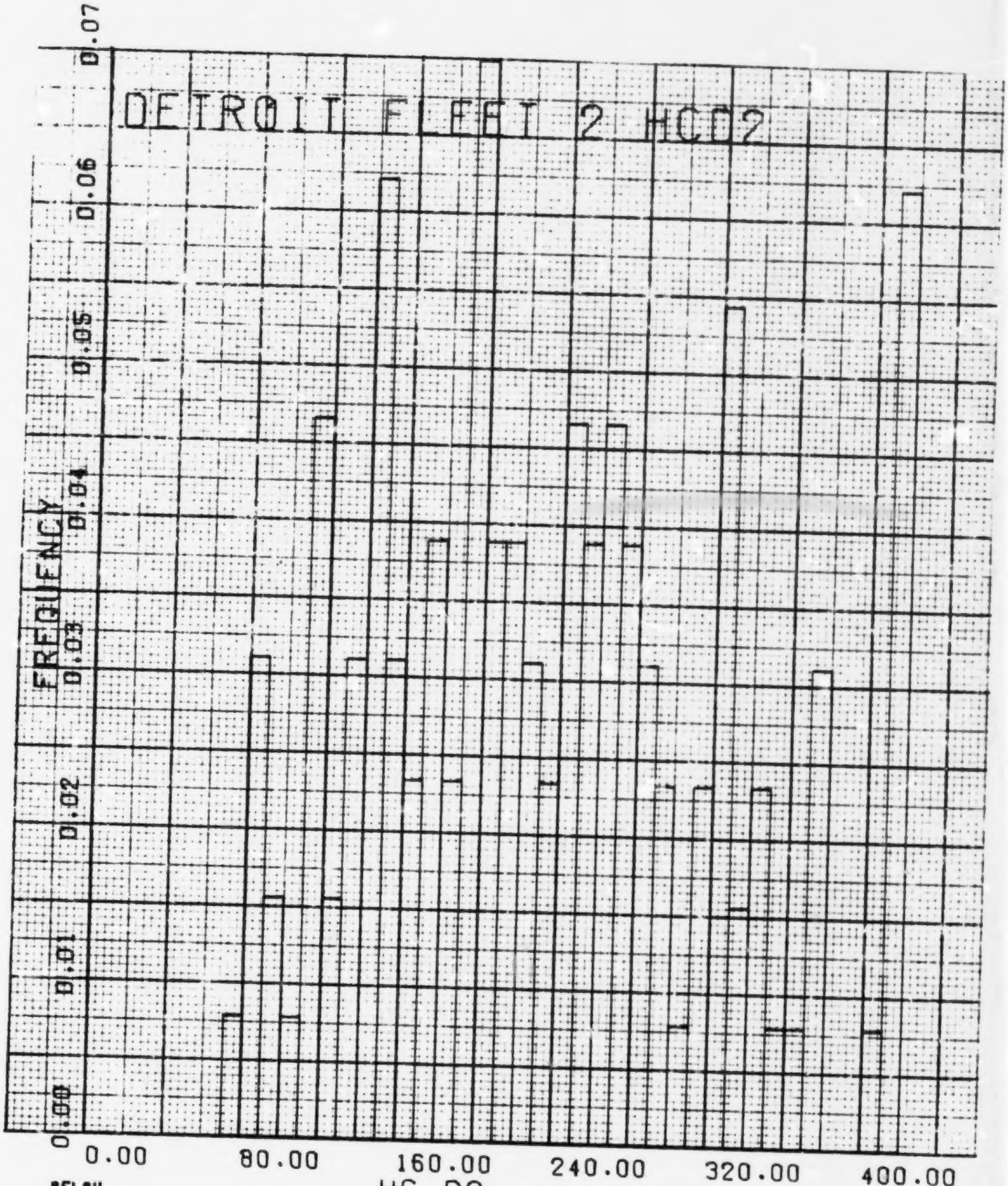

DETROIT FLEET 2 HCD2
FREQUENCY
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.00
80.00
160.00
240.00
320.00
400.00
BELOW
HC D2, ppm
ABOVE

FIGURE 4.8

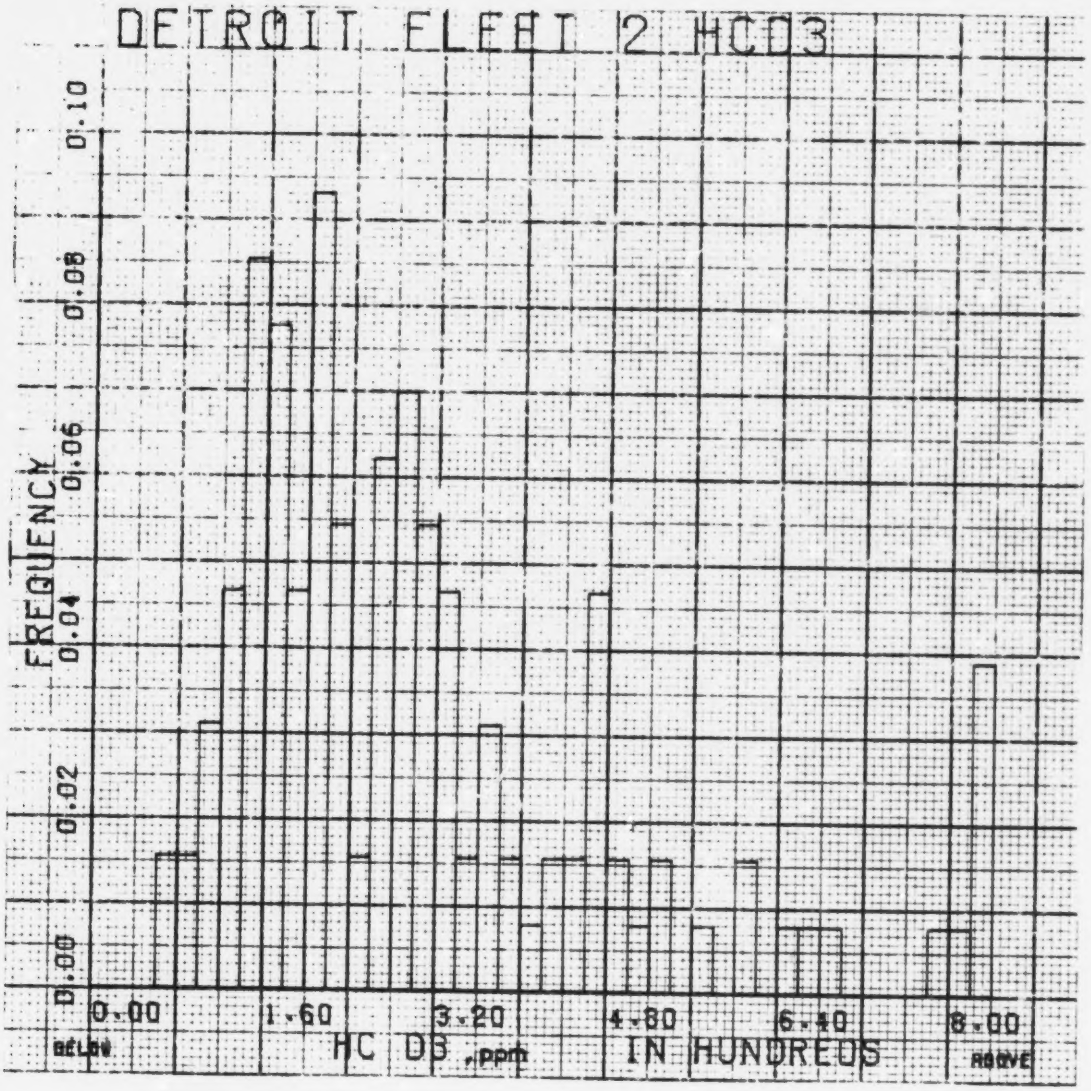

DETROIT FLEET 2 HCD3
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
ABOVE
HC D3 ,ppm IN HUNDREDS

FIGURE 4.9

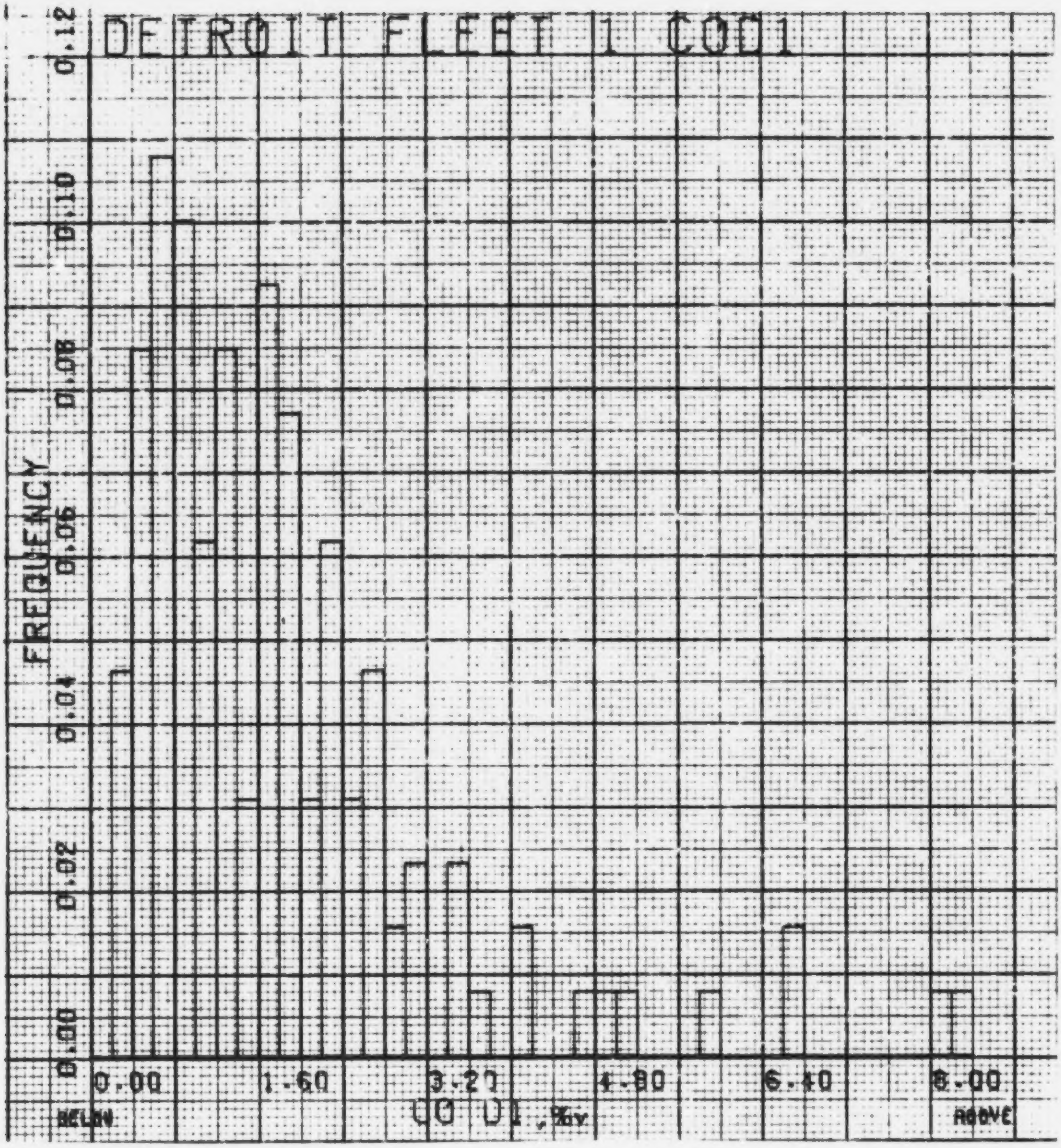

DETROIT FLEET 1 COD1
FREQUENCY
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
CO D1 ,%v
ABOVE

FIGURE 4.10

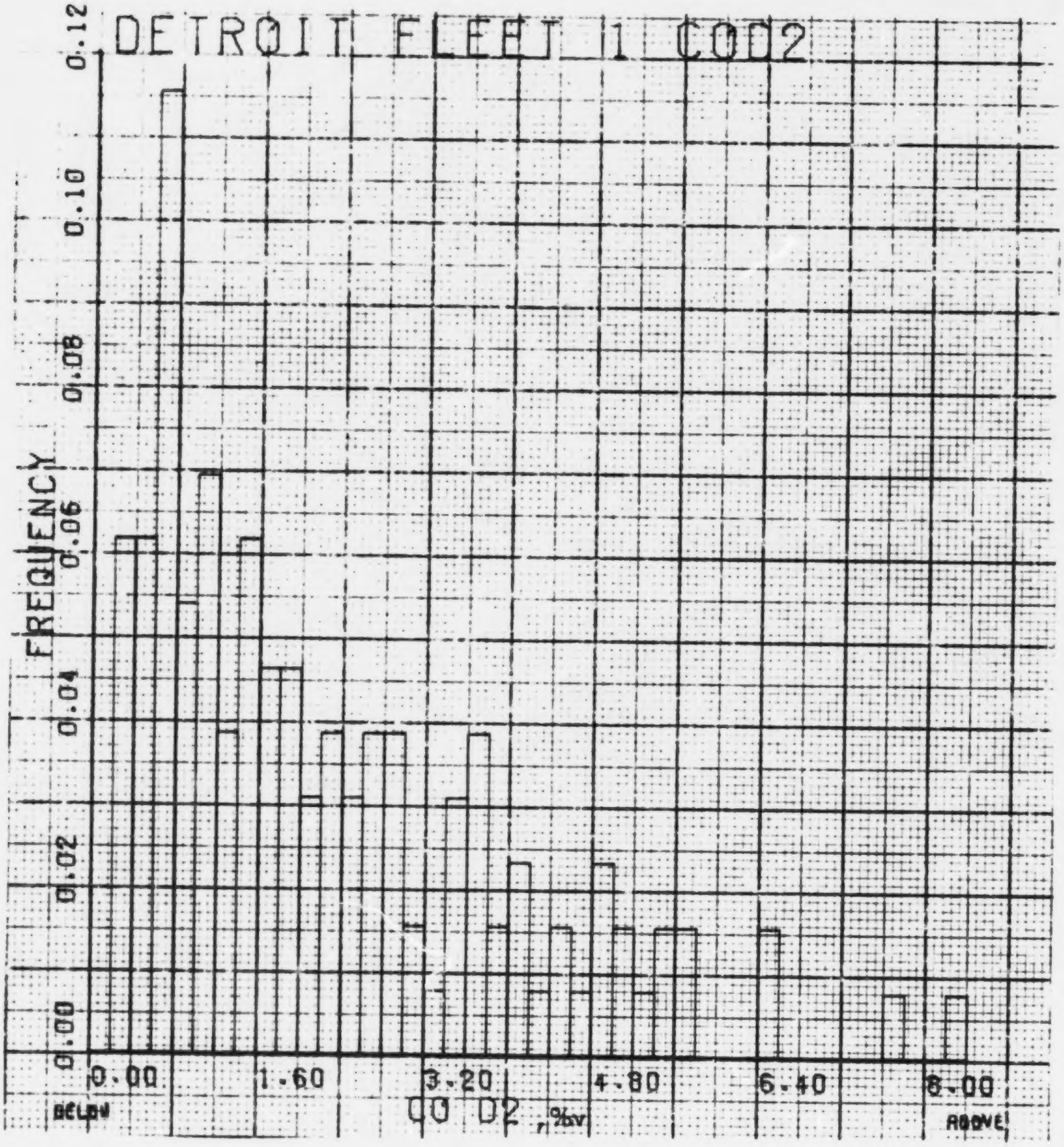

DETROIT FLEET 1 CO02
FREQUENCY
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
ABOVE
CO D2 , %v

FIGURE 4.11

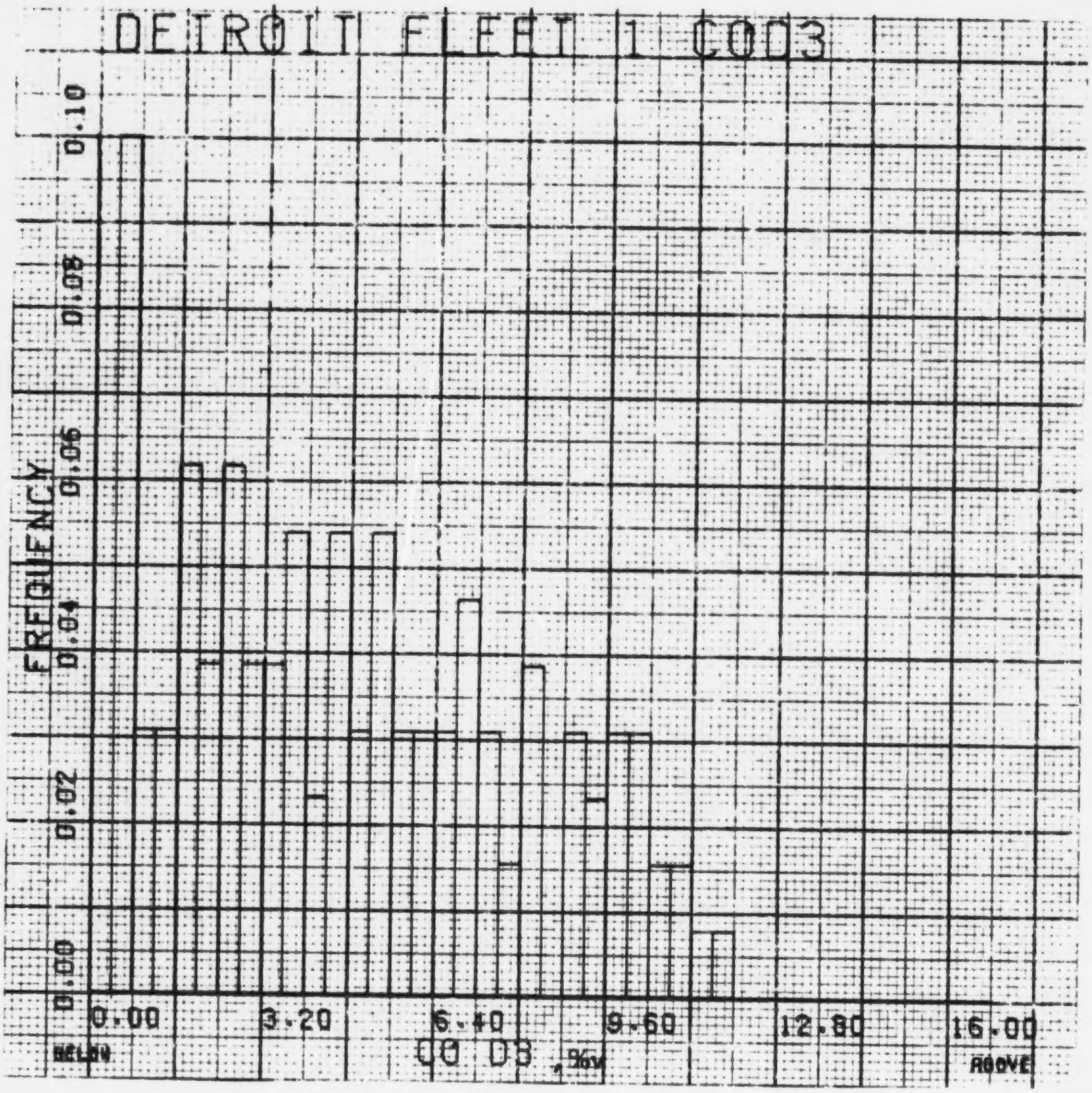

DETROIT FLEET 1 COD3
FREQUENCY
0.10
0.08
0.06
0.04
0.02
0.00
0.00
3.20
6.40
9.60
12.80
16.00
BELOW
ABOVE
CO D3 ,%V

FIGURE 4.12

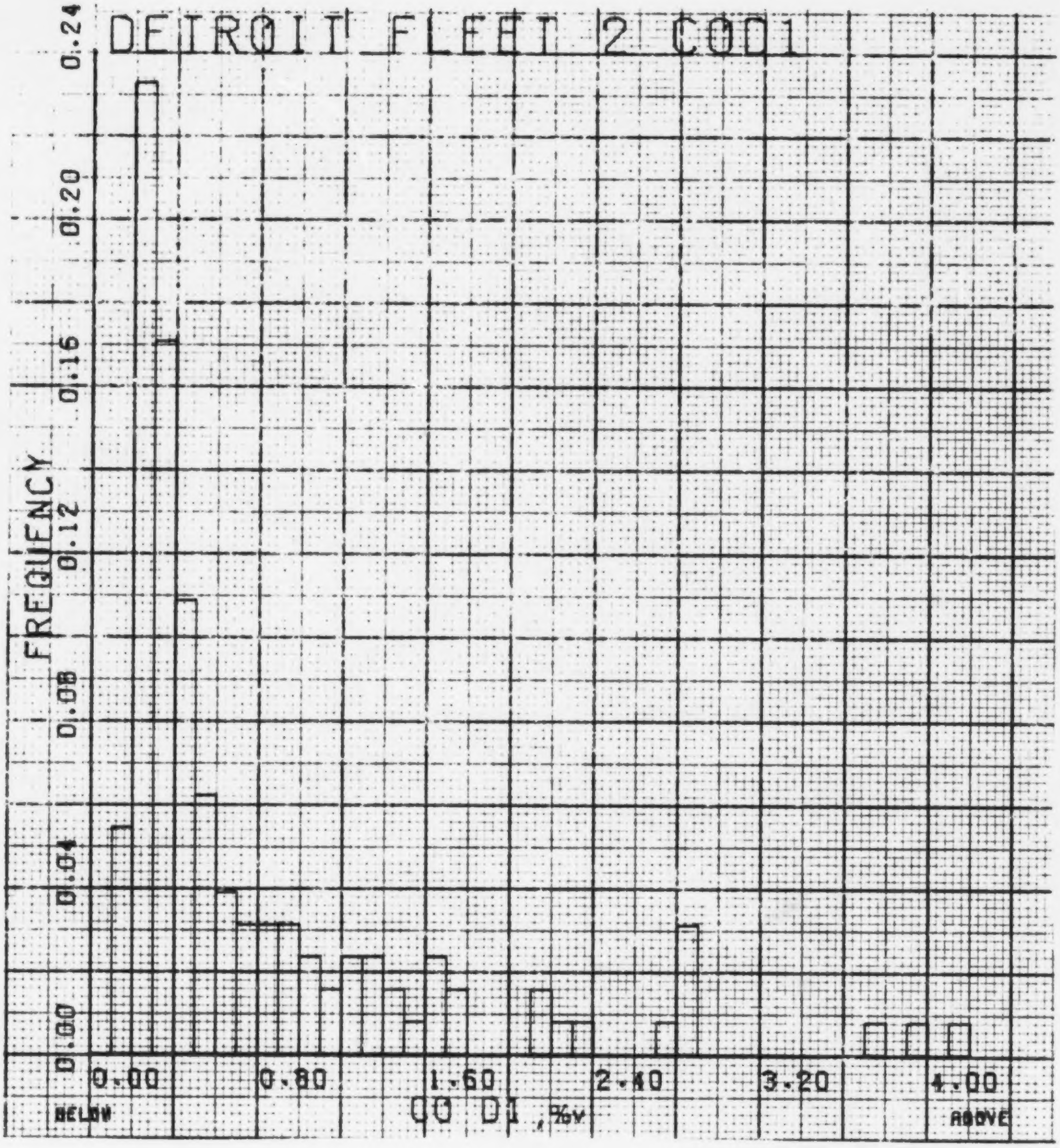

DETROIT FLEET 2 CO01
FREQUENCY
0.24
0.20
0.16
0.12
0.08
0.04
0.00
0.00
0.80
1.60
2.40
3.20
4.00
BELOW
ABOVE
CO D1 ,%V

FIGURE 4.13

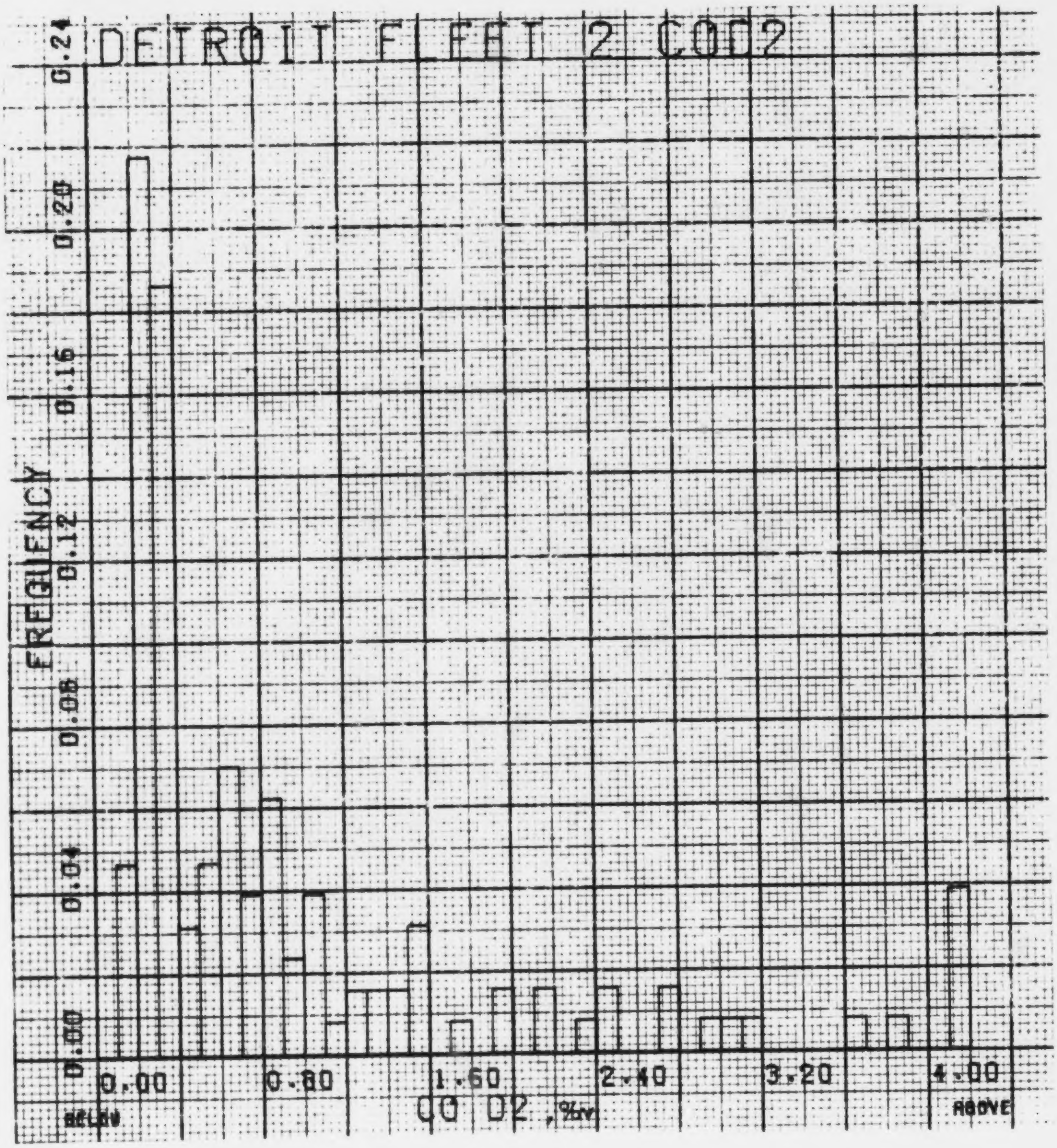

DETROIT FLEET 2 COD2
FREQUENCY
0.24
0.20
0.16
0.12
0.08
0.04
0.00
0.00
0.80
1.60
2.40
3.20
4.00
BELOW
ABOVE
CO O2 ,%V

FIGURE 4.14

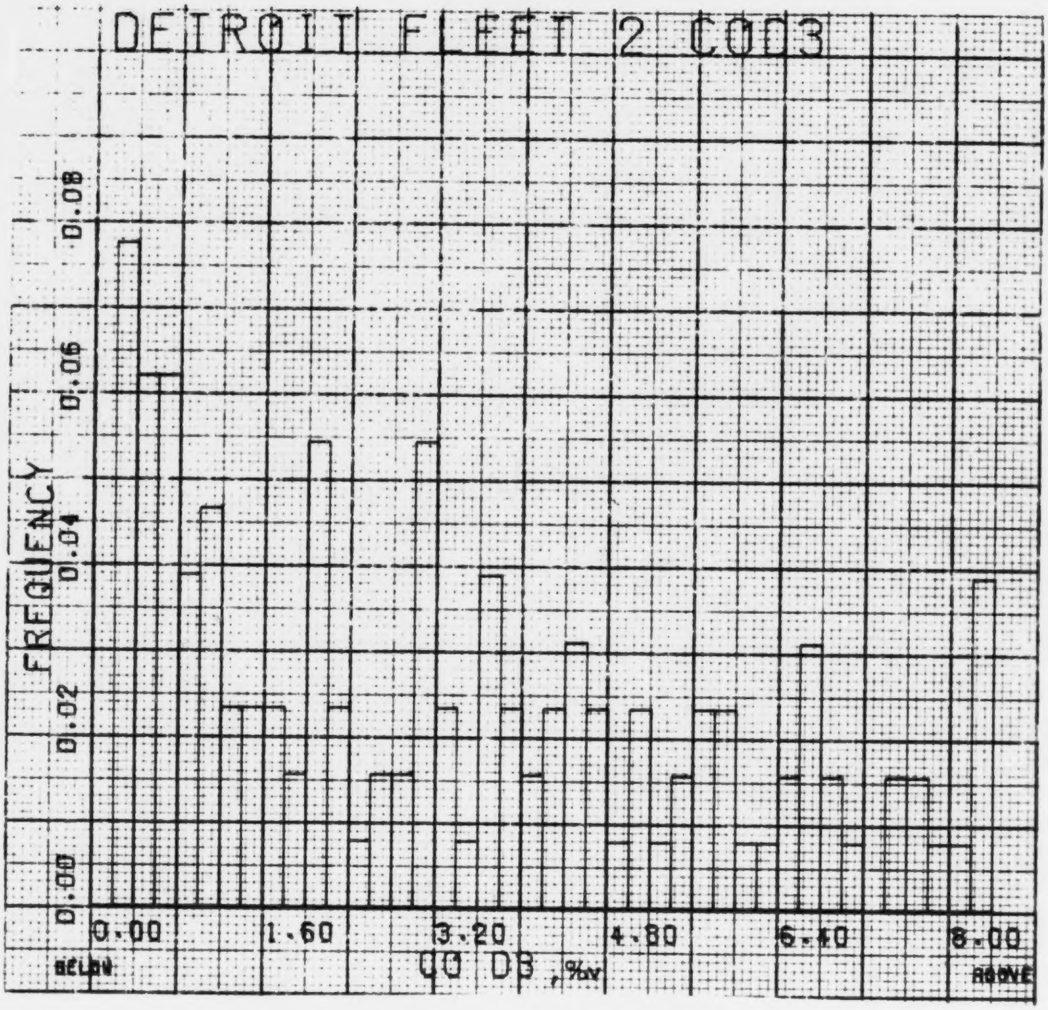

DETROIT FLEET 2 COD3
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
ABOVE
CO DB ,%v

FIGURE 4.15

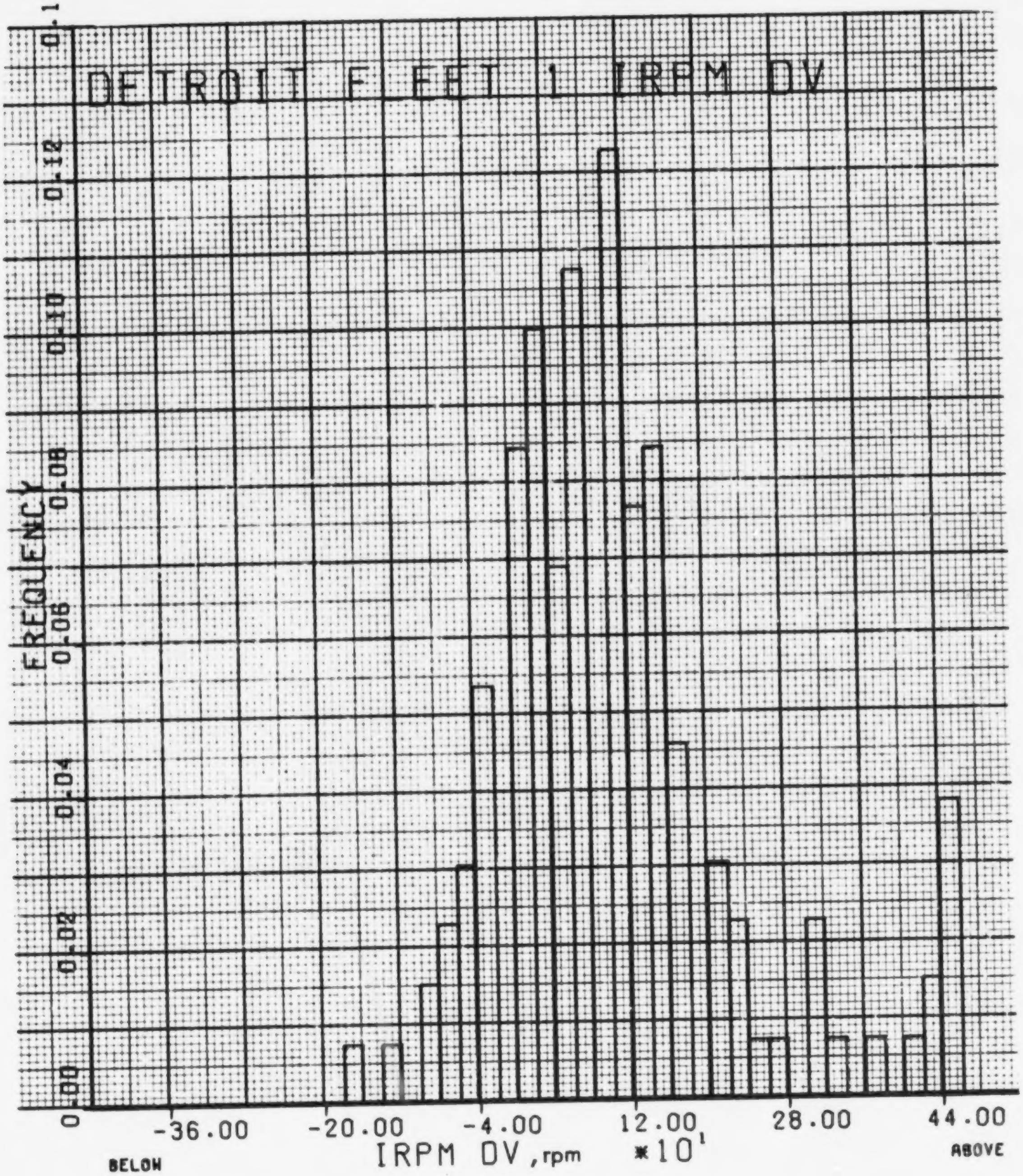

DETROIT F EET 1 IRPM DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
-36.00
-20.00
-4.00
12.00
28.00
44.00
BELOW
IRPM DV, rpm *10¹
ABOVE

FIGURE 4.16

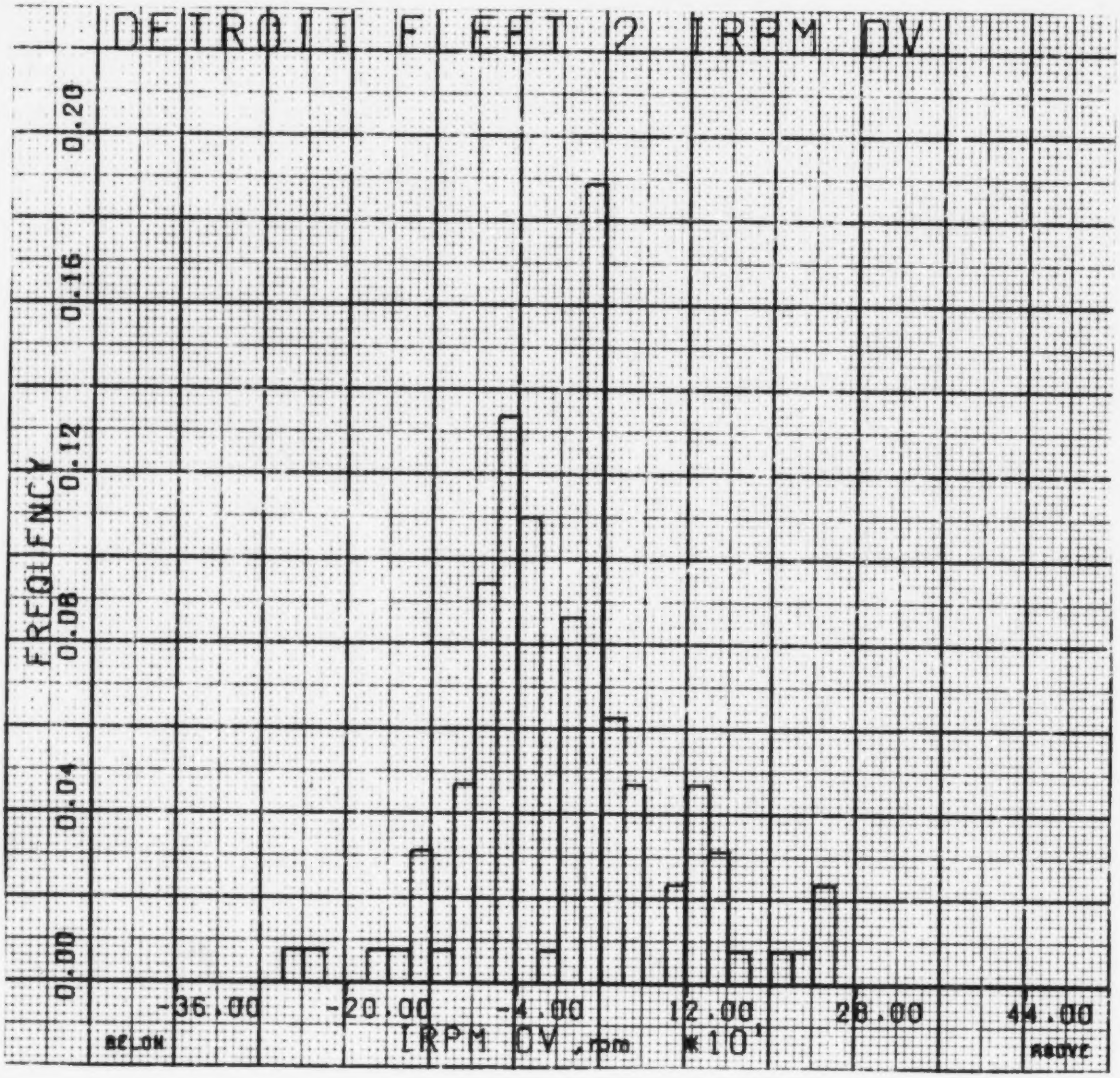

DETROIT FLEET 2 IRPM DV
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
-36.00
-20.00
-4.00
12.00
28.00
44.00
BELOW
ABOVE
IRPM DV ,rpm *10'

FIGURE 4.17

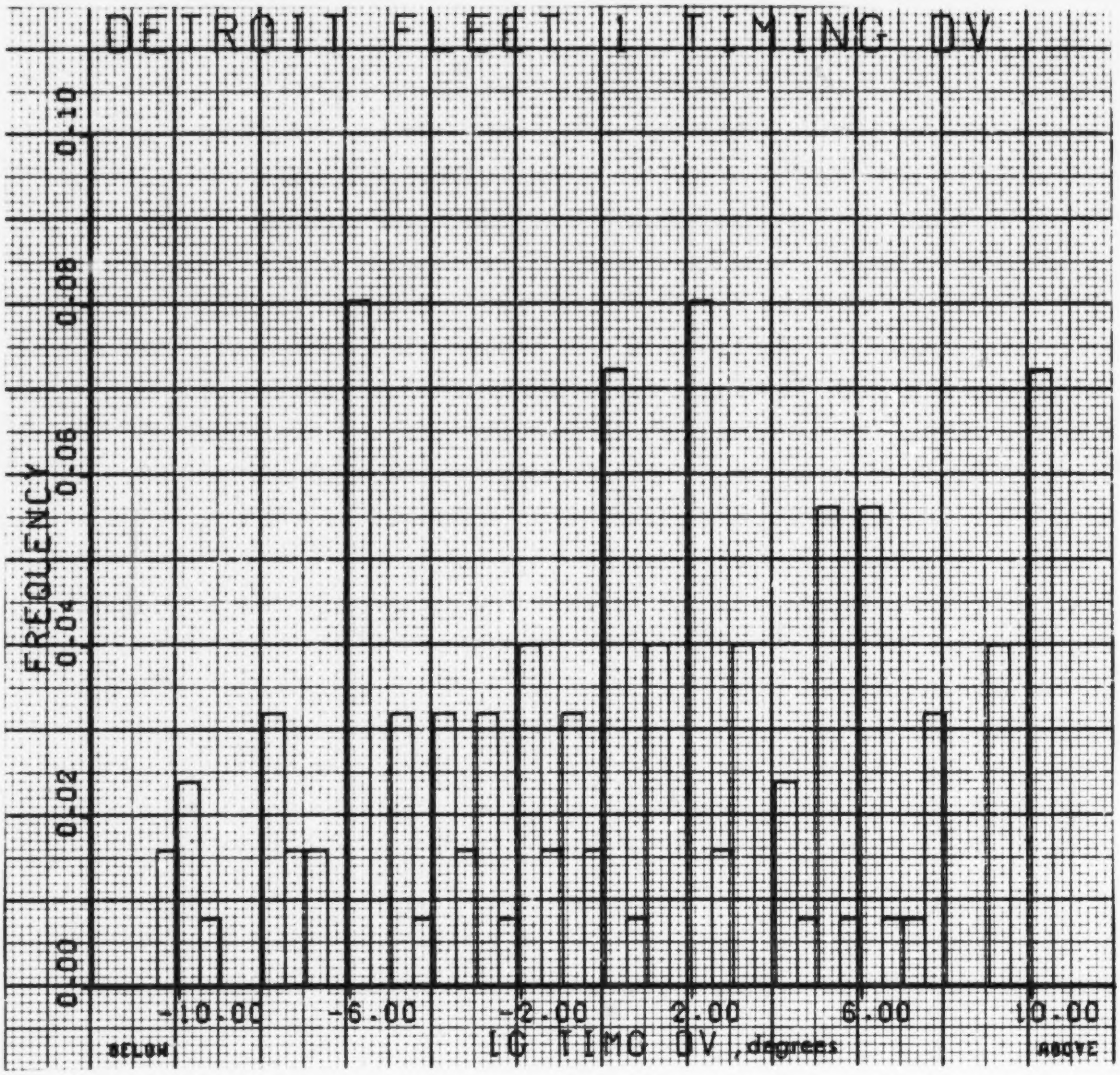
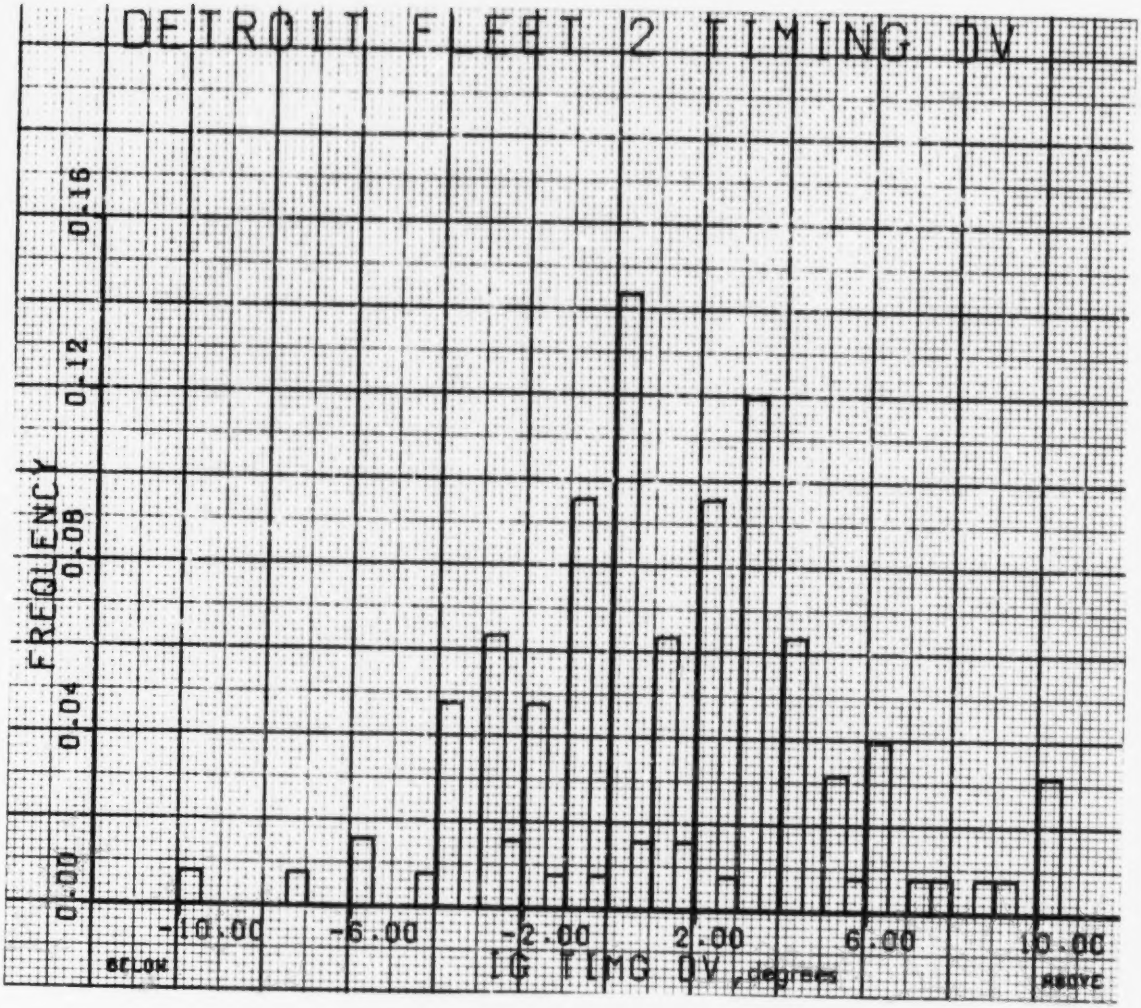

DETROIT FLEET 1 TIMING DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
-10.00
-6.00
-2.00
2.00
6.00
10.00
BELOW
IG TIMG DV, degrees
ABOVE

FIGURE 4.18


DETROIT FLEET 2 TIMING DV
FREQUENCY
0.00
0.04
0.08
0.12
0.16
-10.00
-6.00
-2.00
2.00
6.00
10.00
BELOW
ABOVE
IG TIMG DV ,degrees

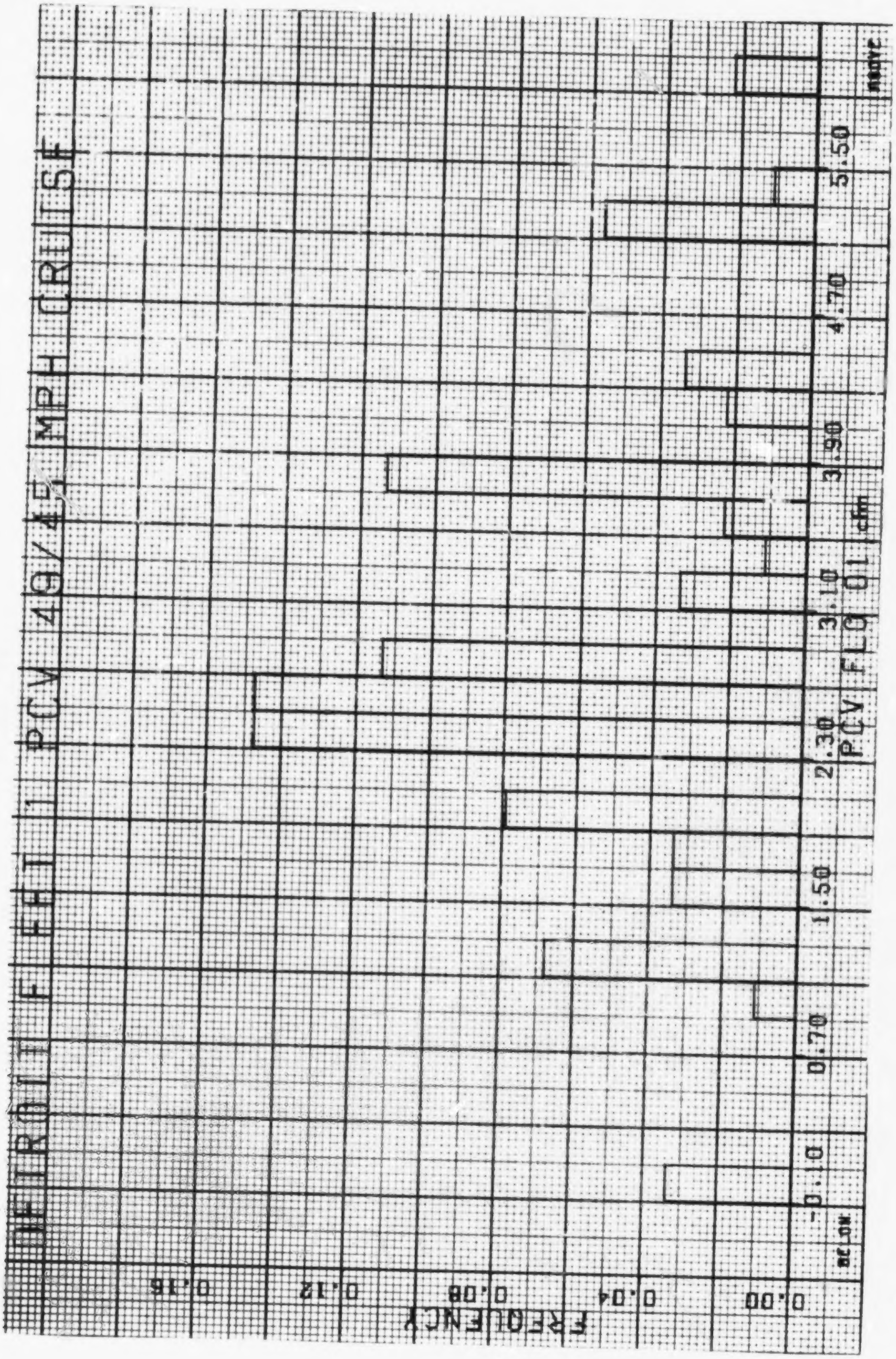

DETROIT F FHT 1 PCV 40/45 MPH CRUISE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
BELOW
-0.10
0.70
1.50
2.30
3.10
3.90
4.70
5.50
ABOVE
PCV FLO 01 cfm

FIGURE 4.19

FIGURE 4.20

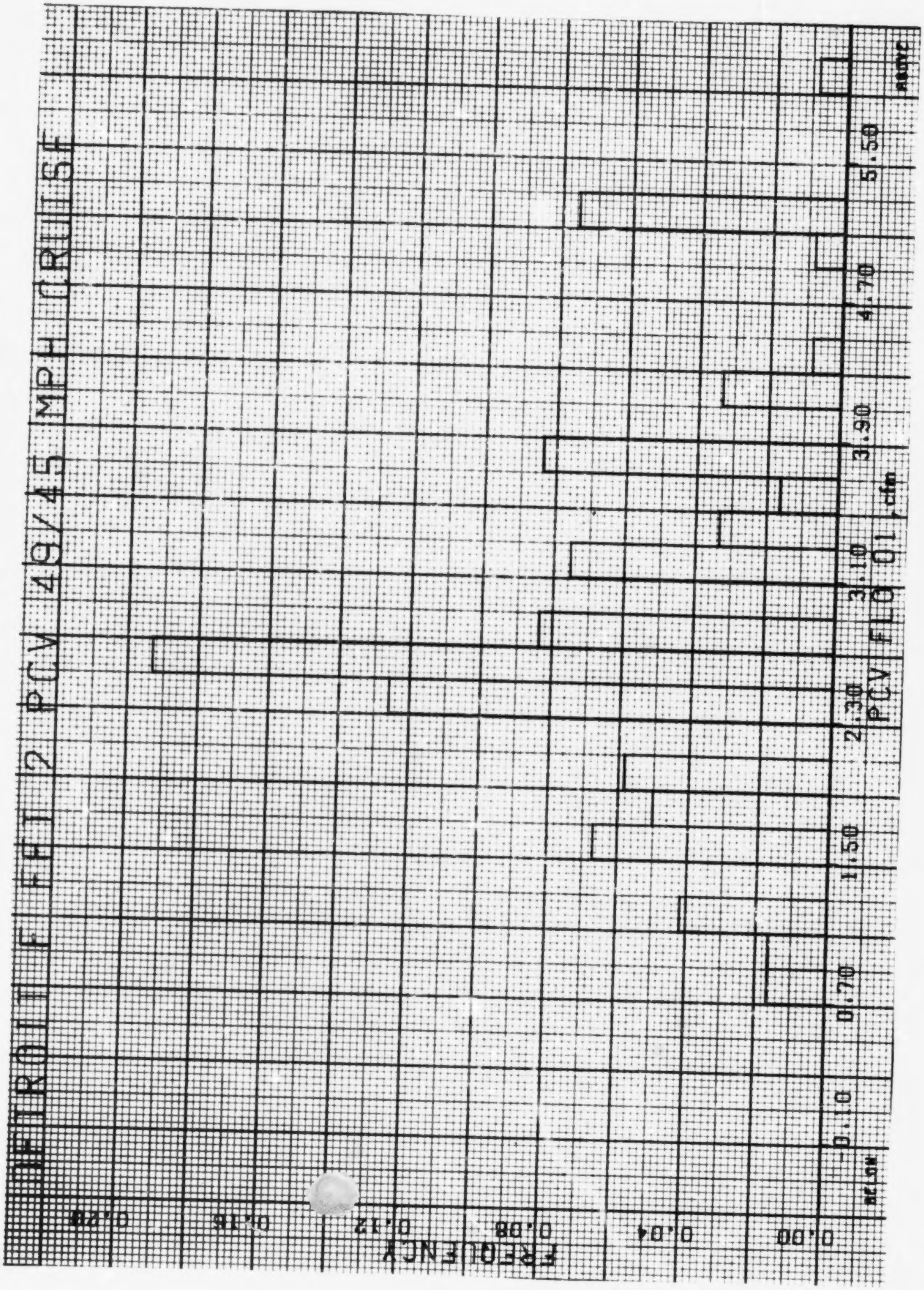

DETROIT FHI 2 PCV 49/45 MPH CRUISE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
BELOW
-0.10
0.70
1.50
2.30
3.10
3.90
4.70
5.50
ABOVE
PCV FLO 01, cfm

FIGURE 4.21

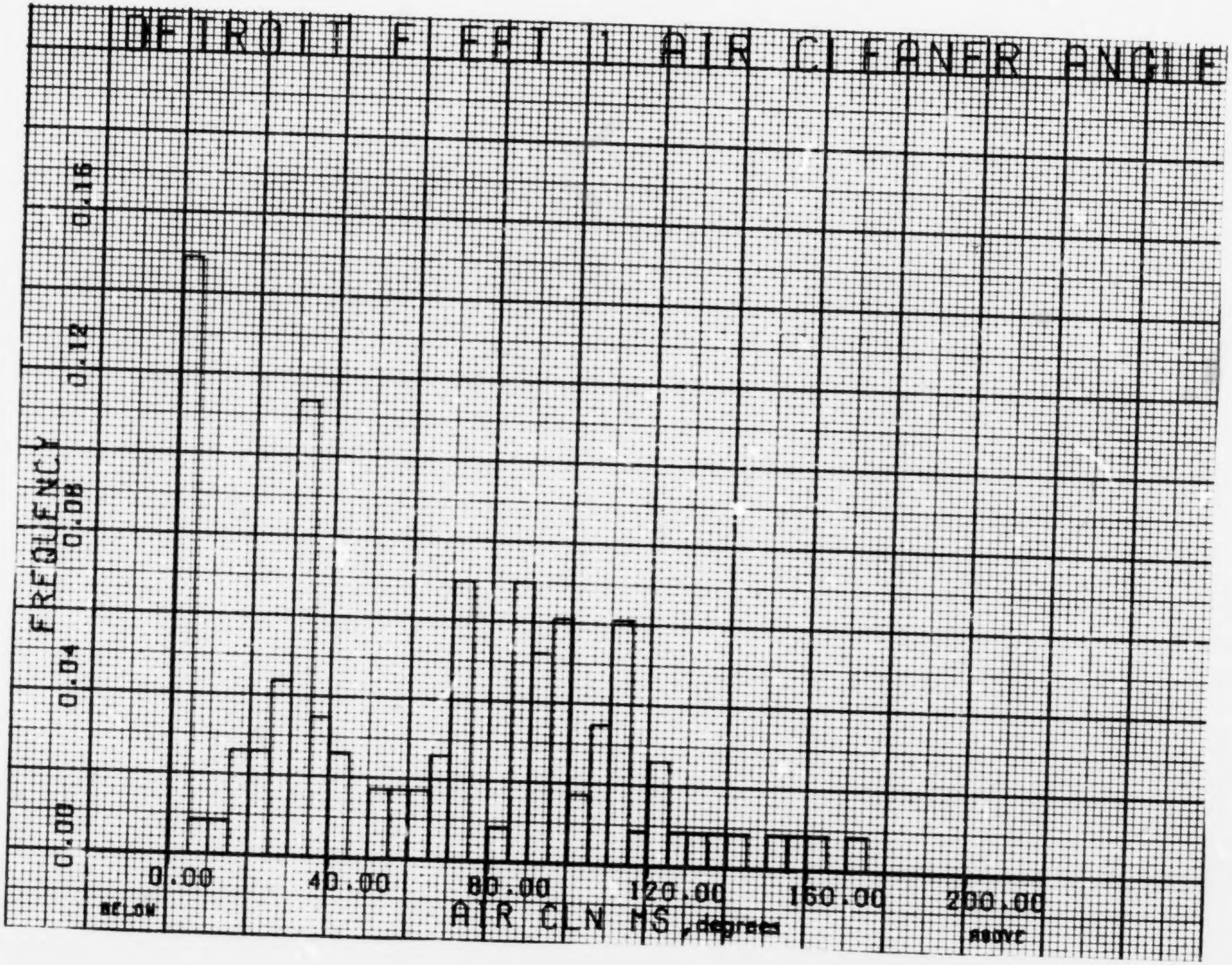

DETROIT F FAT 1 AIR CLEANER ANGLE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
BELOW
0.00
40.00
80.00
120.00
160.00
200.00
ABOVE
AIR CLN MS ,degrees

FIGURE 4.22

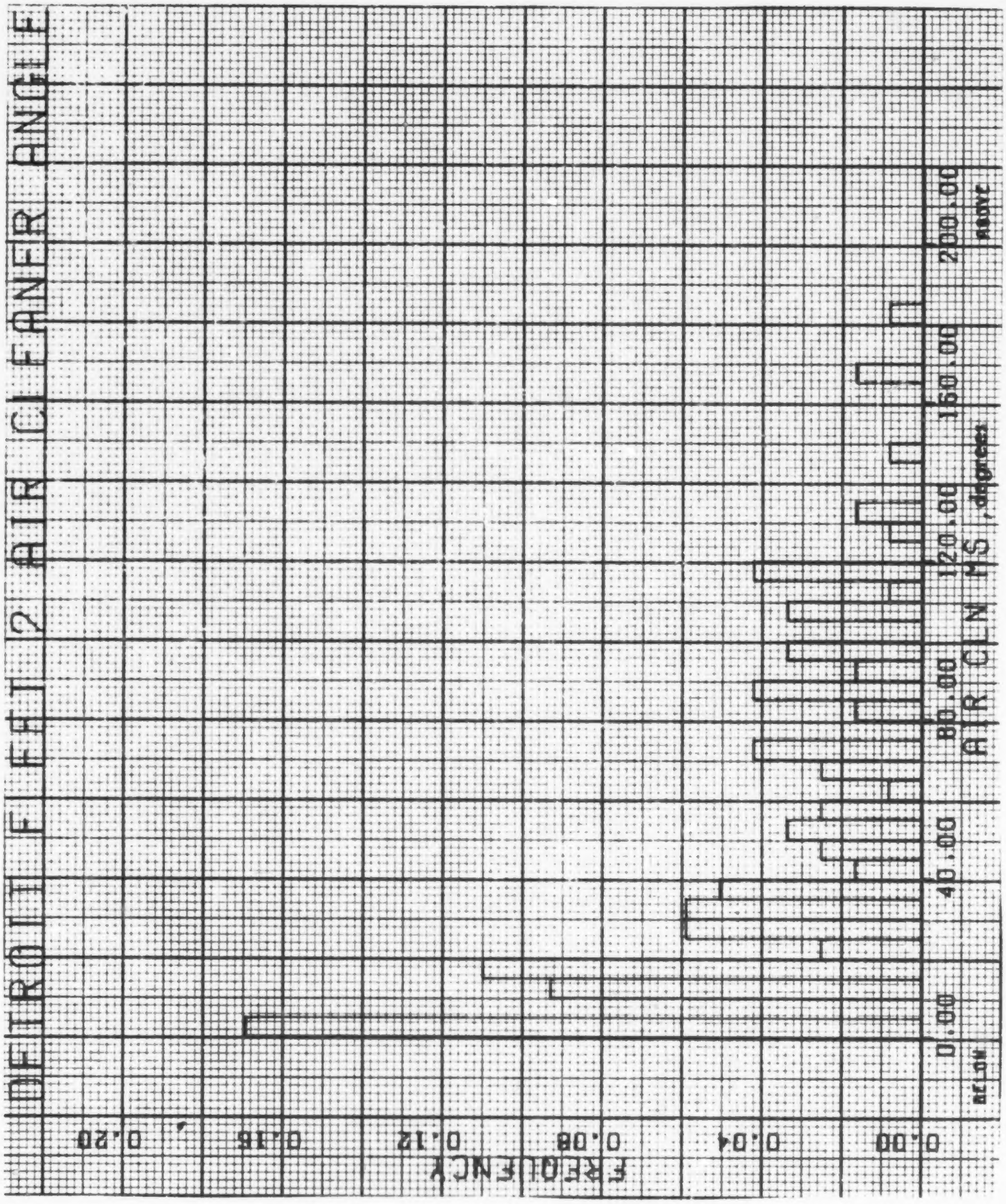

DETROIT E FAT 2 AIR CLEANER ANGLE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
BELOW
0.00
40.00
80.00
120.00
160.00
200.00
ABOVE
AIR CLN MS, degrees

FIGURE 4.23

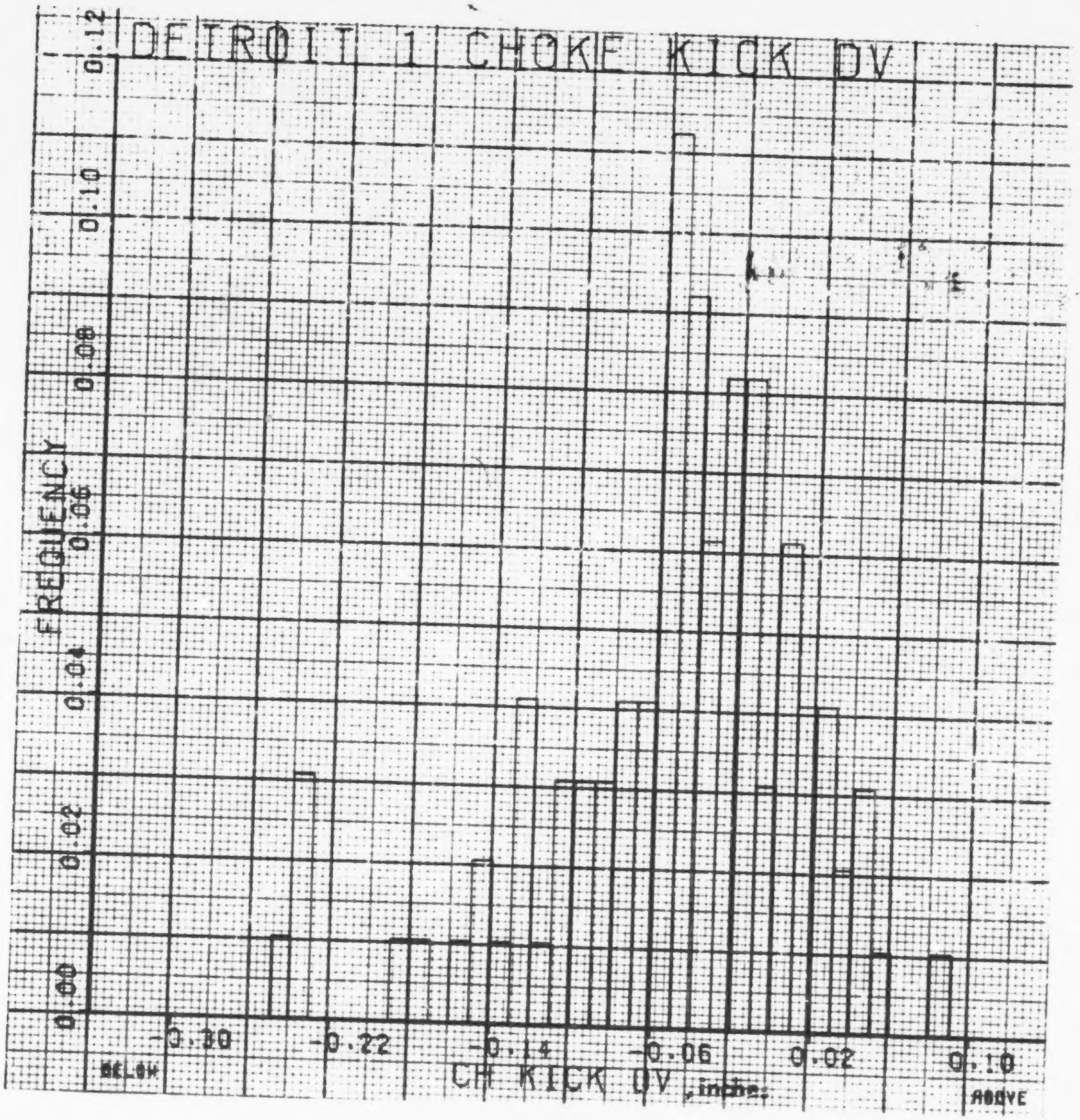
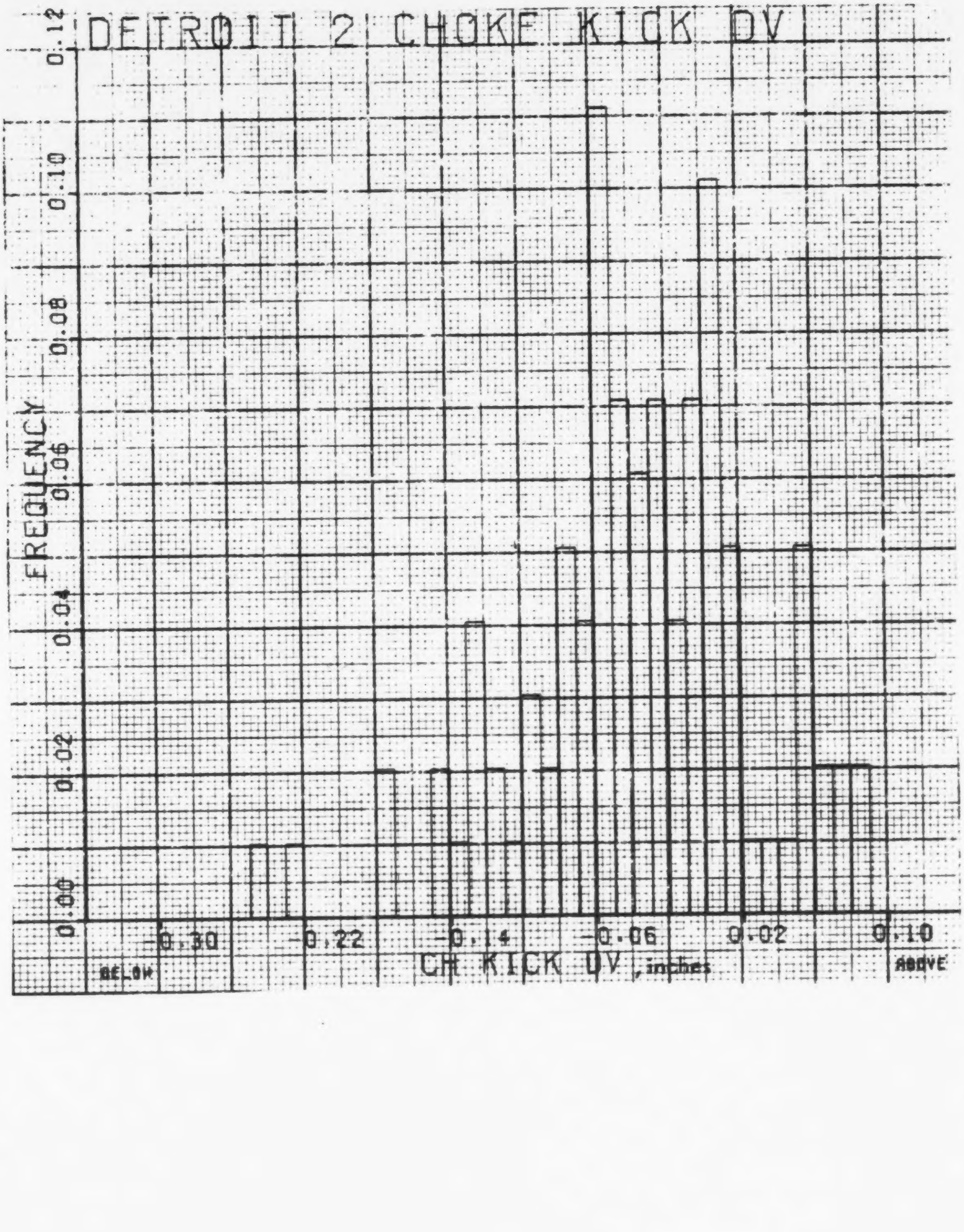

DETROIT 1 CHOKE KICK DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
BELOW
-0.30
-0.22
-0.14
-0.06
0.02
0.10
ABOVE
CH KICK DV ,inches

FIGURE 4.24


DETROIT 2 CHOKE KICK DV
FREQUENCY
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.30
-0.22
-0.14
-0.06
0.02
0.10
BELOW
CH KICK DV ,inches
ABOVE

a log-normal distribution (Figures 4.21 and 4.22). The distributions of choke kick deviations are approximated with normal distributions but Figures 4.23 and 4.24 clearly illustrate skewed distribution toward larger values. These histograms, althcugh skewed in some cases, suggest that preliminary trends can be established with standard statistical tests. This approach is consistent also with that used in the analysis of the California data, Section 2.

4.5 REGIONAL COMPARISON OF VEHICLE EMISSIONS AND ENGINE PARAMETERS

Vehicle maintenance states were first contrasted between Detroit and San Bernardino for each of the similar vehicle fleets sorted by emission control type. The results of this analysis, estimates of the mean ($\overline{X}$), standard deviation (S) and degrees of freedom (d.f.), are presented in Table 4.2. A statistical comparison of the emission and engine parameters using student "t" tests indicate that there are a few cases of statistically significant mean differences at the 90 percent confidence level. The carbon monoxide levels measured in the high cruise and idle modes are higher in San Bernardino vehicle fleets. The deviation of the choke kick from the specification value had richer setting in Detroit. The lower exhaust emissions in Detroit may be the result of a combination of newer, more advanced emission control equipment, basic engine changes and lower mileage accumulation.

The lower frequency and level of misfire, substantially explains the lower HC emissions; however, the induction related malfunctions affecting CO are not substantially different.

In order to determine whether or not mileage and model year effects were causing the differences observed in the emission and engine tune parameters, the vehicle fleet in Detroit was partitioned by California model year rather than emission control type. These comparisons show that only CO keymode emissions for the 1960-1965 vehicles were significantly different. The Detroit vehicles tended to again have lower CO emissions, but the mileage accumulations of the Detroit fleet vehicles were still markedly less than the San Bernardino vehicles. The higher HC emissions of California vehicles are probably explained by the higher frequency of ignition misfire (Table 4.2).

TABLE 4.2

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES							EMISSION CONTROLLED VEHICLES							NOX CONTROLLED VEHICLES		
	SAN BERNARDINO (1960-1965)			DETROIT (1960-1967)				SAN BERNARDINO (1966-1970)			DETROIT (1968-1971)				SAN BERNARDINO (1971)		
	$\overline{X}$	S	d.f.	$\overline{X}$	S	d.f.	t	$\overline{X}$	S	d.f.	$\overline{X}$	S	d.f.	t	$\overline{X}$	S	d.f.
HC 72 COLD, g/mile	12.00	7.0	147	-	-	-	-	7.25	5.7	149	-	-	-	-	4.44	1.8	149
CO 72 COLD, g/mile	131.5	63	147	-	-	-	-	86.9	46	149	-	-	-	-	63.4	37	149
NOX 72 COLD, g/mile	3.97	2.0	147	-	-	-	-	6.33	2.6	149	-	-	-	-	5.95	2.0	149
HC D1 (49/45), ppm	383	450	147	332	374	129	1.02	222	306	148	198	107	128	0.84	135	56	149
CO D1 (49/45), % v	3.43	2.6	147	1.64	1.5	129	7.13*	1.22	1.3	149	0.69	0.81	128	4.03*	0.87	1.16	149
NOX D1 (49/45), ppm	1666	864	147	-	-	-	-	2613	976	149	-	-	-	-	2537	740	149
HC D3 (Idle), ppm	865	989	146	603	582	128	2.64*	376	546	148	300.	230	128	1.55	240	199	149
CO D3 (Idle), % v	6.08	3.0	147	4.50	3.1	129	4.41*	4.09	2.6	149	3.15	2.5	128	3.08*	3.34	2.7	149
NOX D3 (Idle), ppm	126.8	122	147	-	-	-	-	124.2	82	149	-	-	-	-	168	96	149
TIMING, degrees (DV)	0.35	5.7	148	0.62	6.0	123	-0.38	0.50	4.6	149	1.07	3.7	124	-1.11	0.17	3.4	147
IRPM, rpm (DV)	77.9	137	148	108.5	146	129	-1.81	-18.2	108	149	2.5	90	126	-1.72	-5.68	138	149
AIR CLN ANGLE, degrees	60.0	53	137	61.7	45	113	-0.27	45.6	53	137	47	44	117	-0.23	28.8	43	130
PCV FLO D1, cfm	2.87	1.3	126	2.86	1.3	87	0.05	2.62	0.97	138	2.85	1.2	118	-1.71	2.58	0.90	135
CHOKE KICK, in. (DV)	$9.24x10^{-3}$	$4.88x10^{-2}$	79	-.0511	0.0654	97	6.85	$-4.42x10^{-3}$	$4.6x10^{-2}$	122	-.0372	0.0643	98	4.43*	$-9.56x10^{-3}$	$4.06x10^{-2}$	126
HEAT RISER, % failed	53.1	-	80	68.0	-	77	-	44.0	-	74	42.5	-	65	-	3.4	-	29
VACUUM DIAPH, % failed	25.0	-	27	32.6	-	42	-	21.7	-	91	21.3	-	79	-	0.0	-	123
MISFIRE D1, %	12.3	11.3	6	14.5	1.8	4	-0.51	2.6	0.4	2	4.7	0.4	1	-5.75	-	-	-
MISFIRE D2, %	14.4	9.6	6	15.1	1.7	4	-0.18	4.6	3.6	2	4.8	2.4	1	-0.07	-	-	-
MISFIRE D3, %	17.5	12.0	6	13.9	3.8	4	0.74	11.5	9.7	2	4.2	0.9	1	1.30	-	-	-
AIR PUMP, % failed	-	-	-	-	-	-	-	20.0	-	34	-	-	-	-	-	-	-
NOX CONTROL, % failed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.9	-	81
MILEAGE, miles	83358	26047	148	58280	19377	129	-	43786	20567	148	27863	17340	128	-	8059	6451	149

*Estimates of means significantly different (confidence equal to or greater than 90%).

TABLE 4.3

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES						
	SAN BERNARDINO (1960-1965)			DETROIT (1960-1965)			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]
CO 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	—
NOX 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
HC 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (49/43), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
HC 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (Idle), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	—	[illegible]	—	—
TIMING, Degrees (DY)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IRPM, rpm (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AIR CLN ANGLE, Degrees	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PCV FLO 2V, cfm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CRNKC KICK, in (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HEAT RISER, % failed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VACUUM DIAPH, % failed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
MISFIRE LO, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MISFIRE 2V, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MISFIRE HI, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AIR PUMP, % failed	[illegible]		—		—	—	—
NOX CONTROL, % failed	[illegible]		[illegible]			—	—
MILEAGE, miles	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Estimates of means significantly different (confidence equal to or greater than 95%).

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	EMISSION CONTROLLED VEHICLES						
	SAN BERNARDINO (1966-1970)			DETROIT (1966-1970)			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	—	[illegible]	—	[illegible]
CO 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	—	[illegible]	—	—
NOX 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	—	—	—	—
HC 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (49/43), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
HC 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (Idle), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
TIMING, Degrees (DY)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IRPM, rpm (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AIR CLN ANGLE, Degrees	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PCV FLO 2V, cfm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CRNKC KICK, in (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HEAT RISER, % failed	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VACUUM DIAPH, % failed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MISFIRE LO, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MISFIRE 2V, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MISFIRE HI, %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AIR PUMP, % failed	[illegible]	—	[illegible]	—		—	[illegible]
NOX CONTROL, % failed	[illegible]	—	[illegible]	[illegible]		[illegible]	—
MILEAGE, miles	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Estimates of means significantly different (confidence equal to or greater than 95%).

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	NO_x CONTROLLED VEHICLES						
	SAN BERNARDINO (1971)			DETROIT (1971)			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
CO 72 COLD, g/mile	[illegible]	[illegible]	[illegible]		—	—	[illegible]
NOX 72 COLD, g/mile	[illegible]	[illegible]	[illegible]		—	—	—
HC 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (49/43), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (49/43), ppm	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
HC 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO 2V (Idle), % v	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX 2V (Idle), ppm	[illegible]	[illegible]	[illegible]	—	—	—	[illegible]
TIMING, Degrees (DY)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IRPM, rpm (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AIR CLN ANGLE, Degrees	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PCV FLO 2V, cfm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CRNKC KICK, in (DI)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HEAT RISER, % failed	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
VACUUM DIAPH, % failed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
MISFIRE LO, %	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
MISFIRE 2V, %	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
MISFIRE HI, %	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	—
AIR PUMP, % failed	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOX CONTROL, % failed	[illegible]	—	[illegible]				
MILEAGE, miles	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—

*Estimates of means significantly different (confidence equal to or greater than 95%).

In a comparison with the emission controlled vehicle fleets of the two cities in which the mileage accumulations were comparable, no statistical differences in the emission levels are indicated. Some significant differences of Idle RPM, PCV Valve flowrate (49/45 MPH Cruise) and the choke kick deviations were observed. These deviations are in the direction which would explain the somewhat higher CO emissions in the San Bernardino fleet. The slightly lower HC emissions in this fleet reflect a slightly lower frequency of misfire.

With the 1971 vehicles, the HC measurement of the 49/45 MPH Cruise and the CO measurement under the Idle Mode were found to be significantly different. As was the case in the previous comparison, the choke kick deviations for the fleets were significantly different. In general, however, the data indicate reasonable agreement in the distribution of the vehicles of the two cities. Some of the parameters such as Idle RPM which appeared to be set considerably higher in Detroit seem reasonable because of the colder climate. It was surprising, however, that there are equally large numbers of heat riser failures in the Detroit vehicle fleets as there were in the San Bernardino fleets.

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APPENDIX A

ENGINE PARAMETER DETERIORATION STUDY

FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

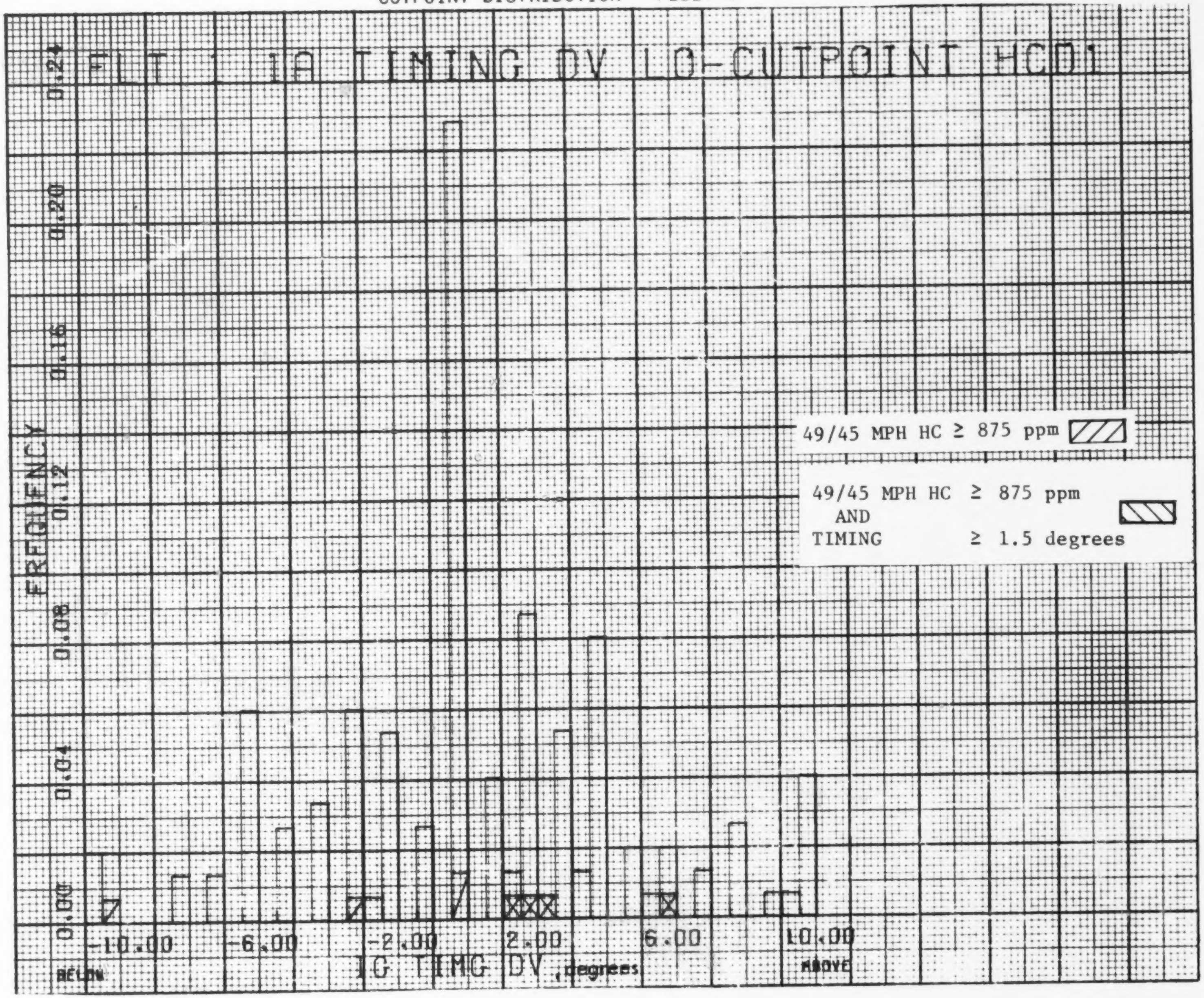


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

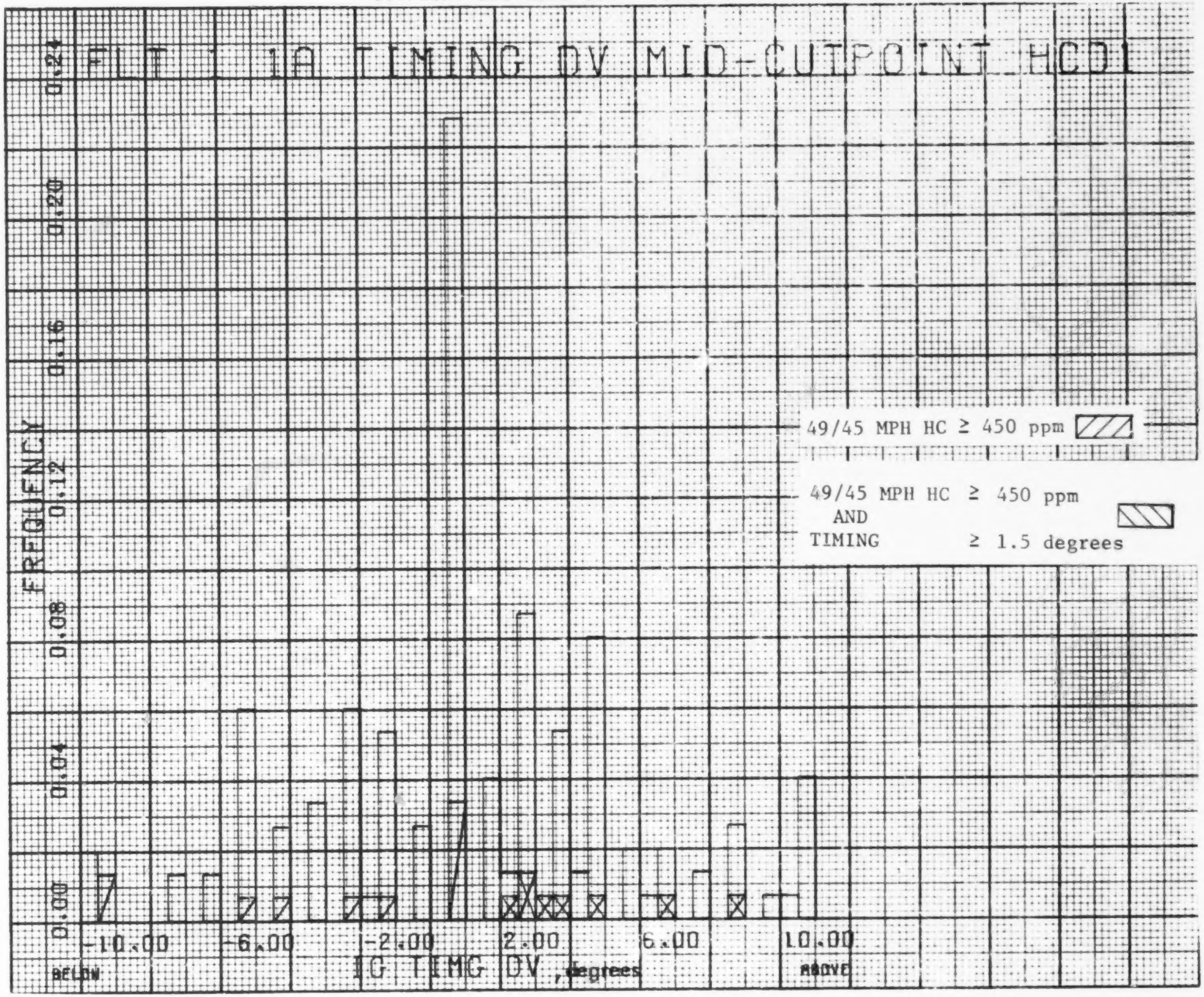
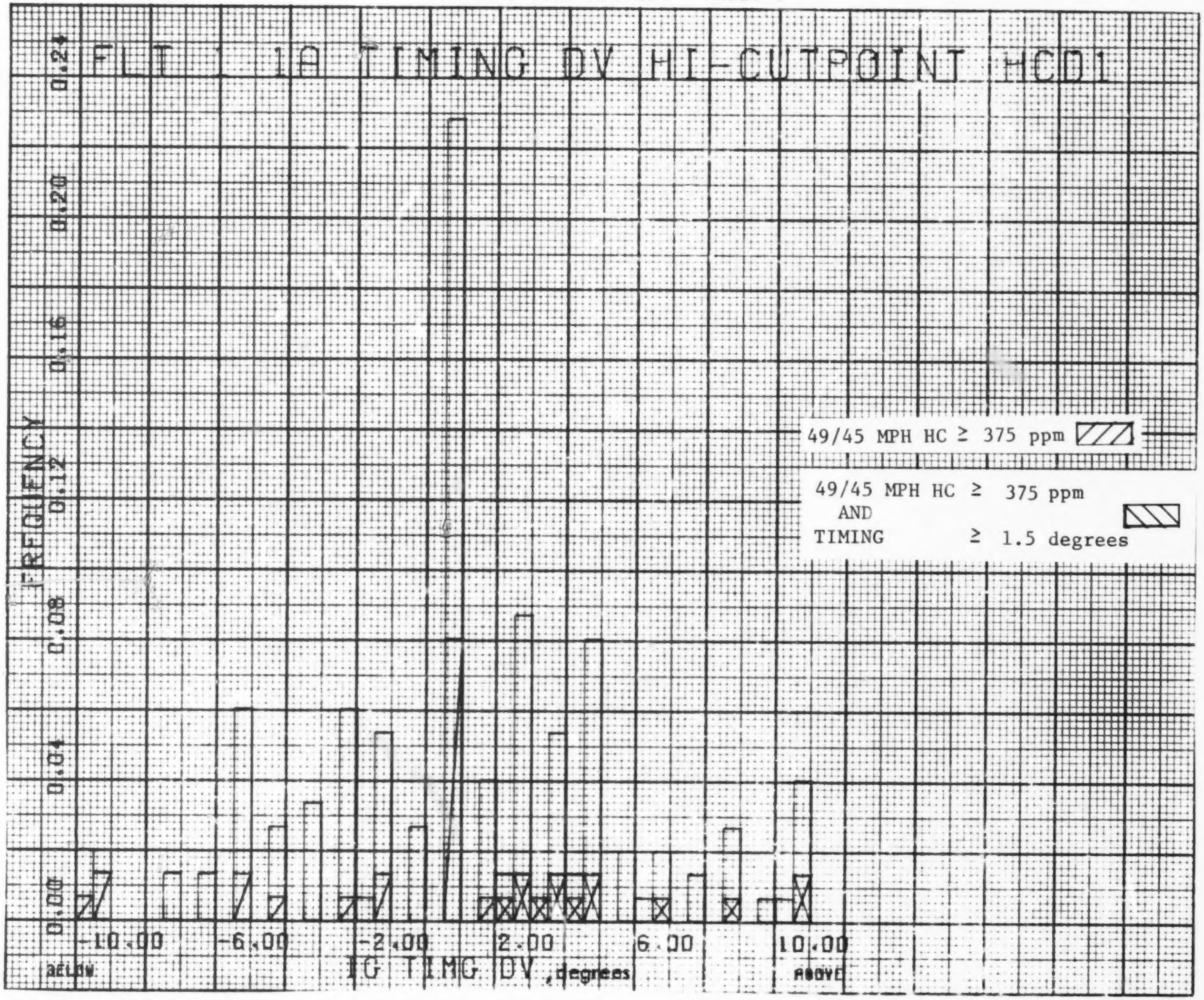


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1



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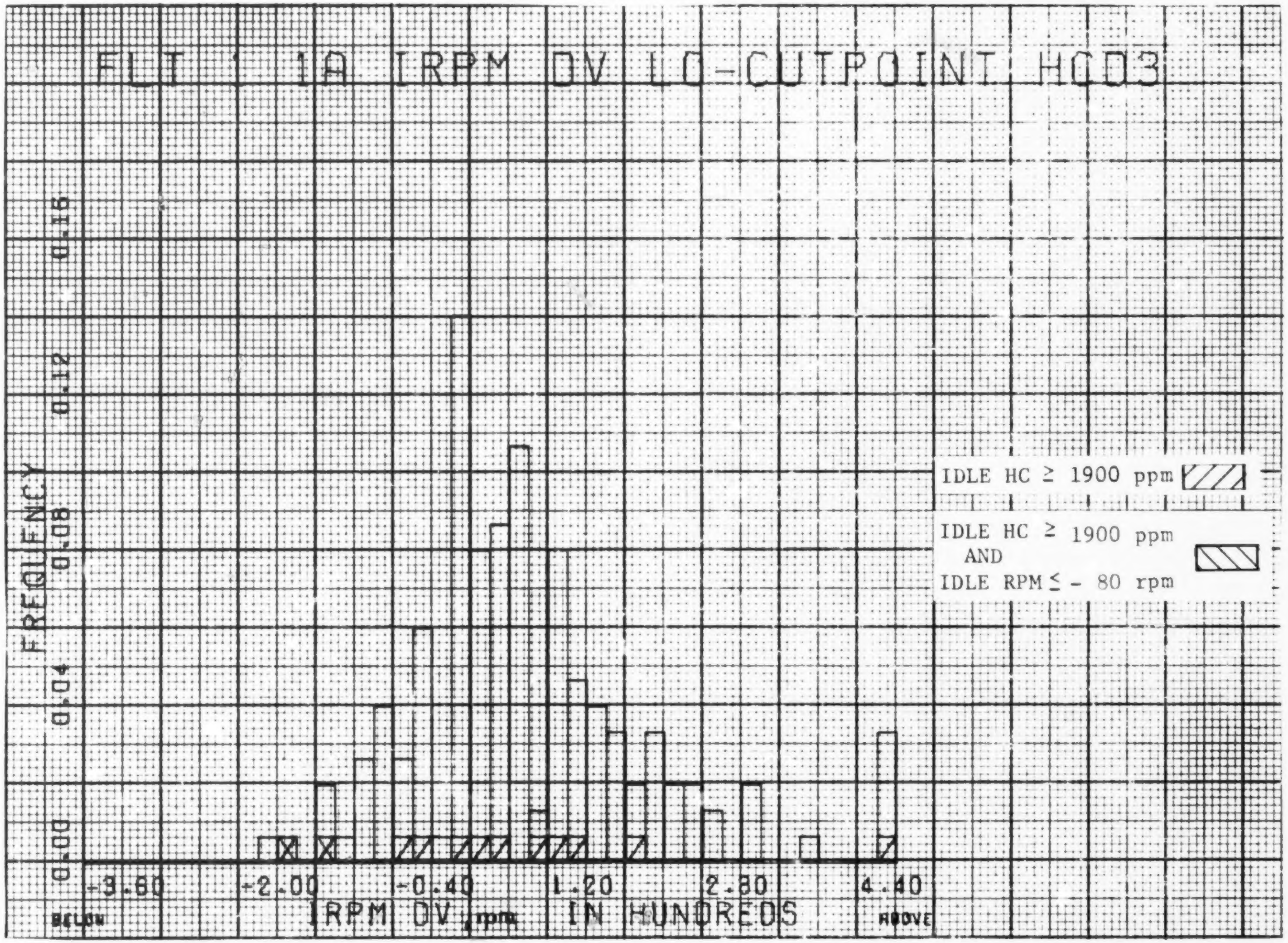

FIGURE 1

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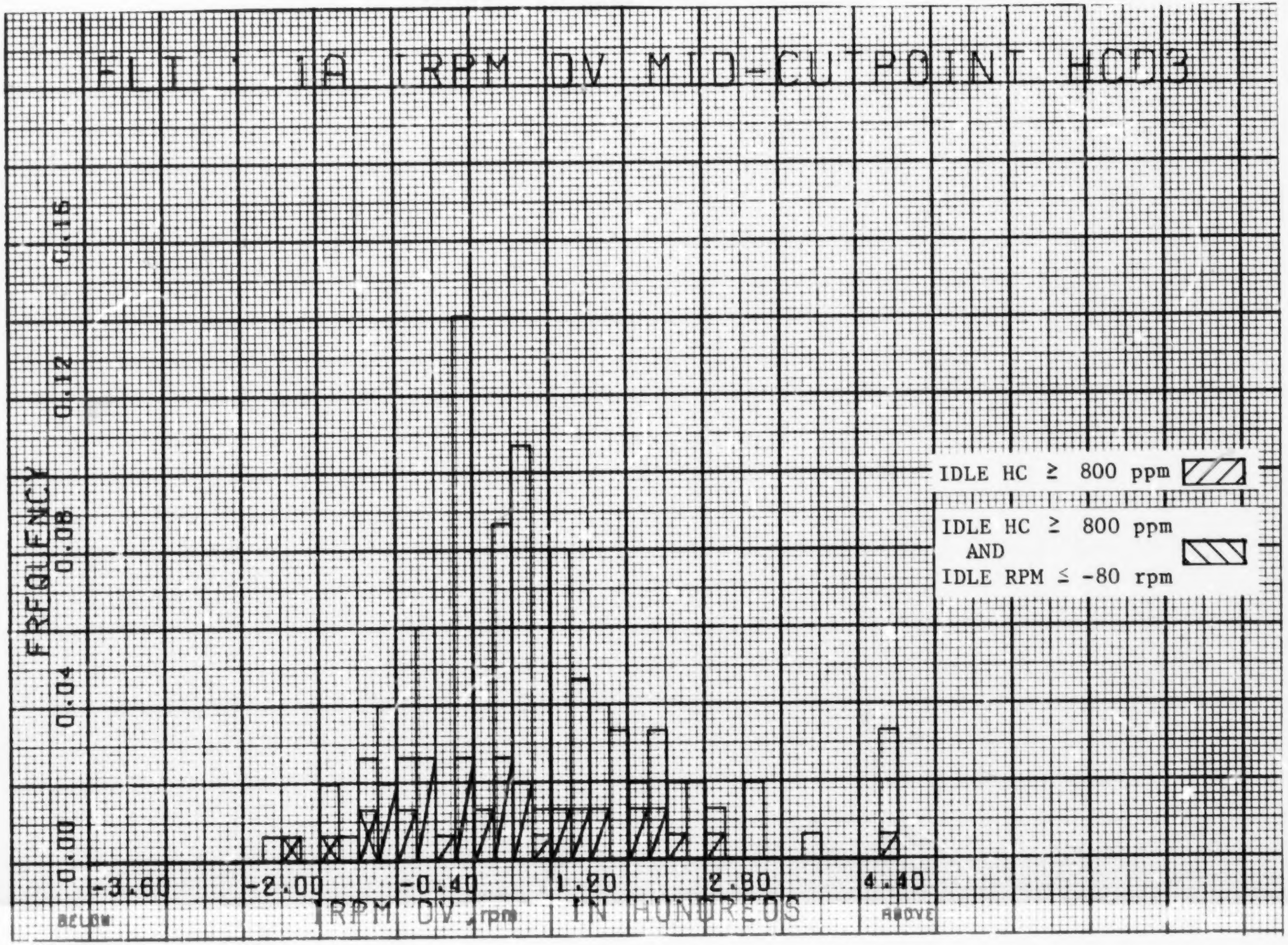

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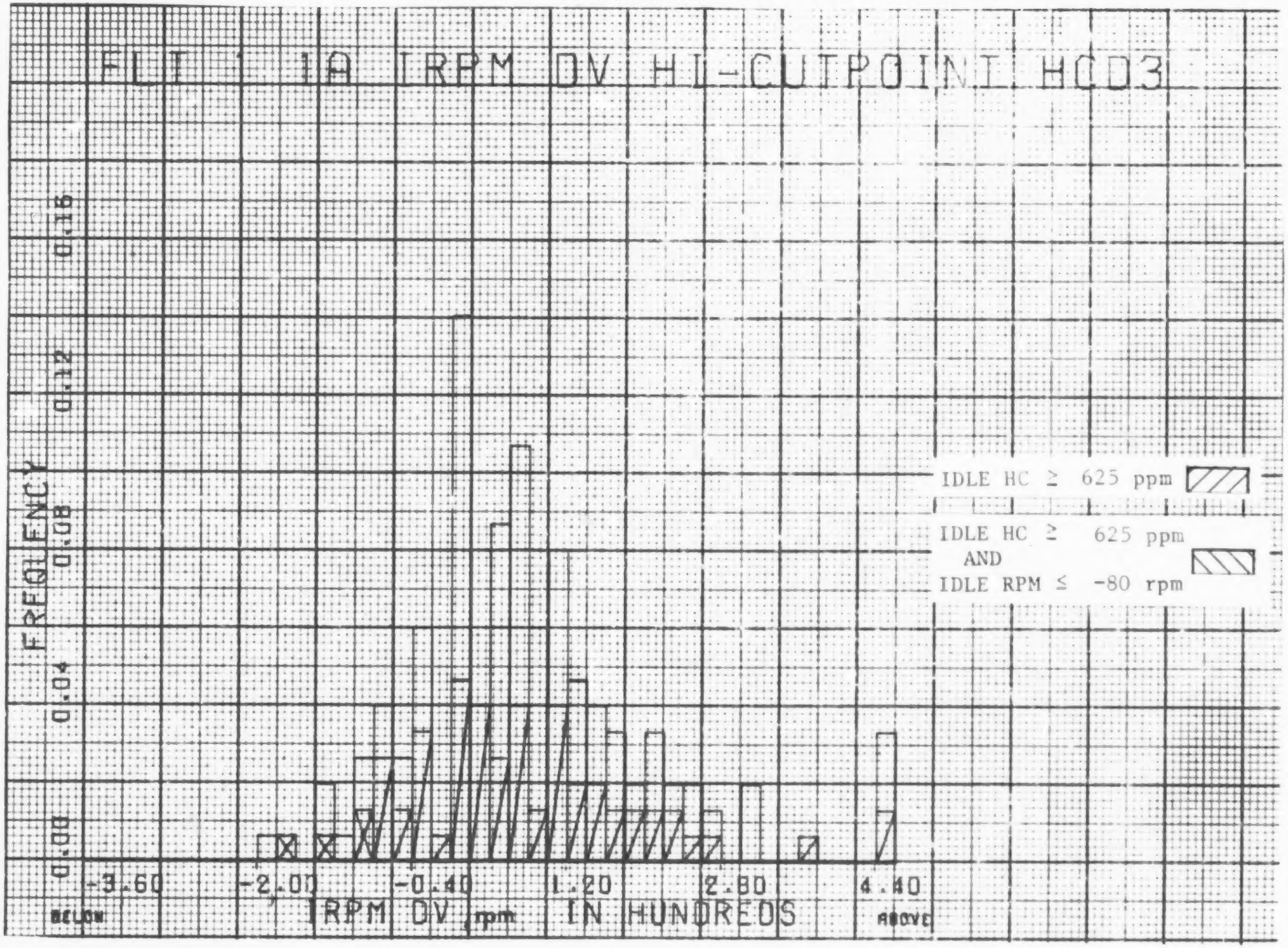

FIGURE 1

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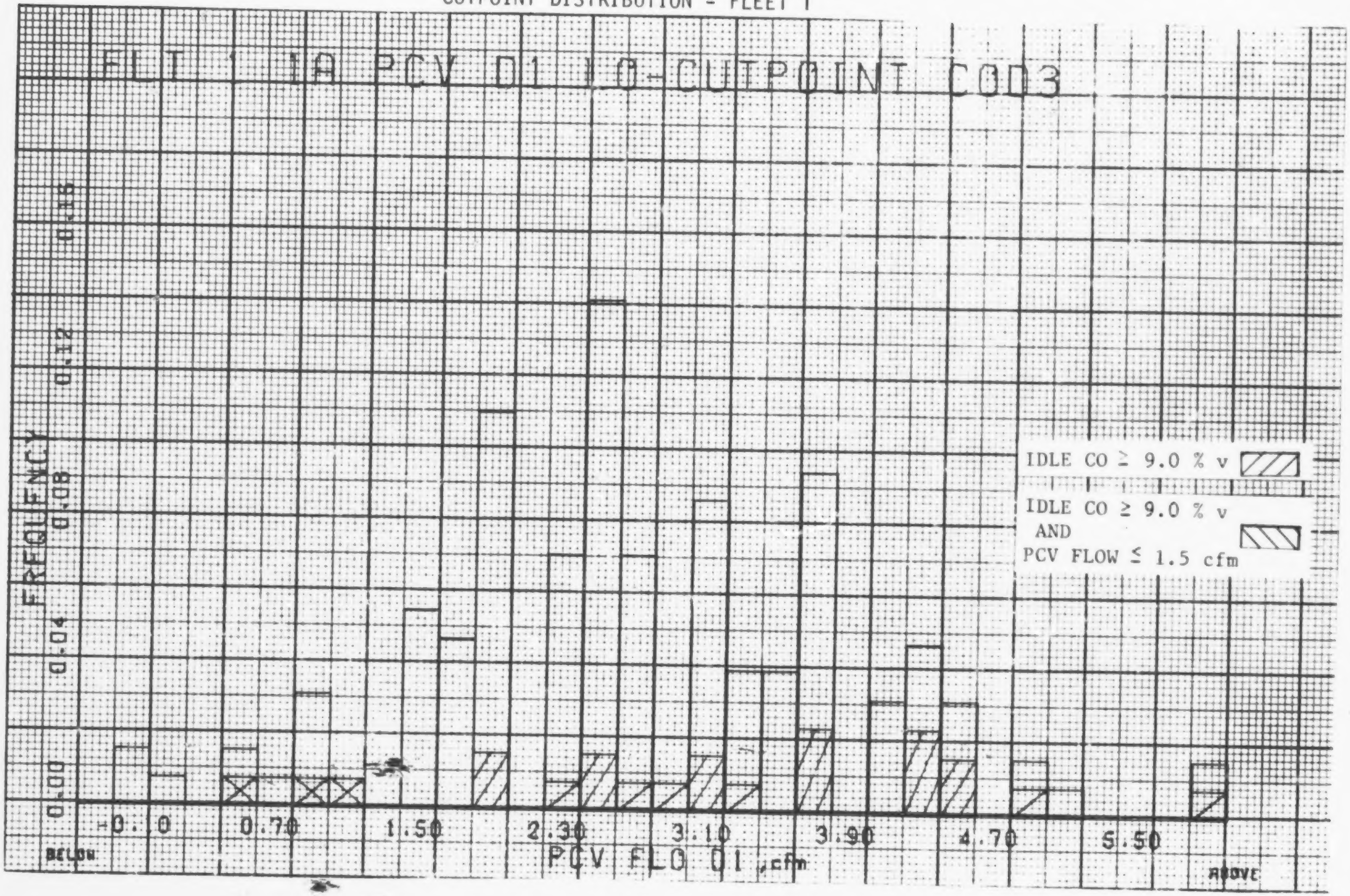

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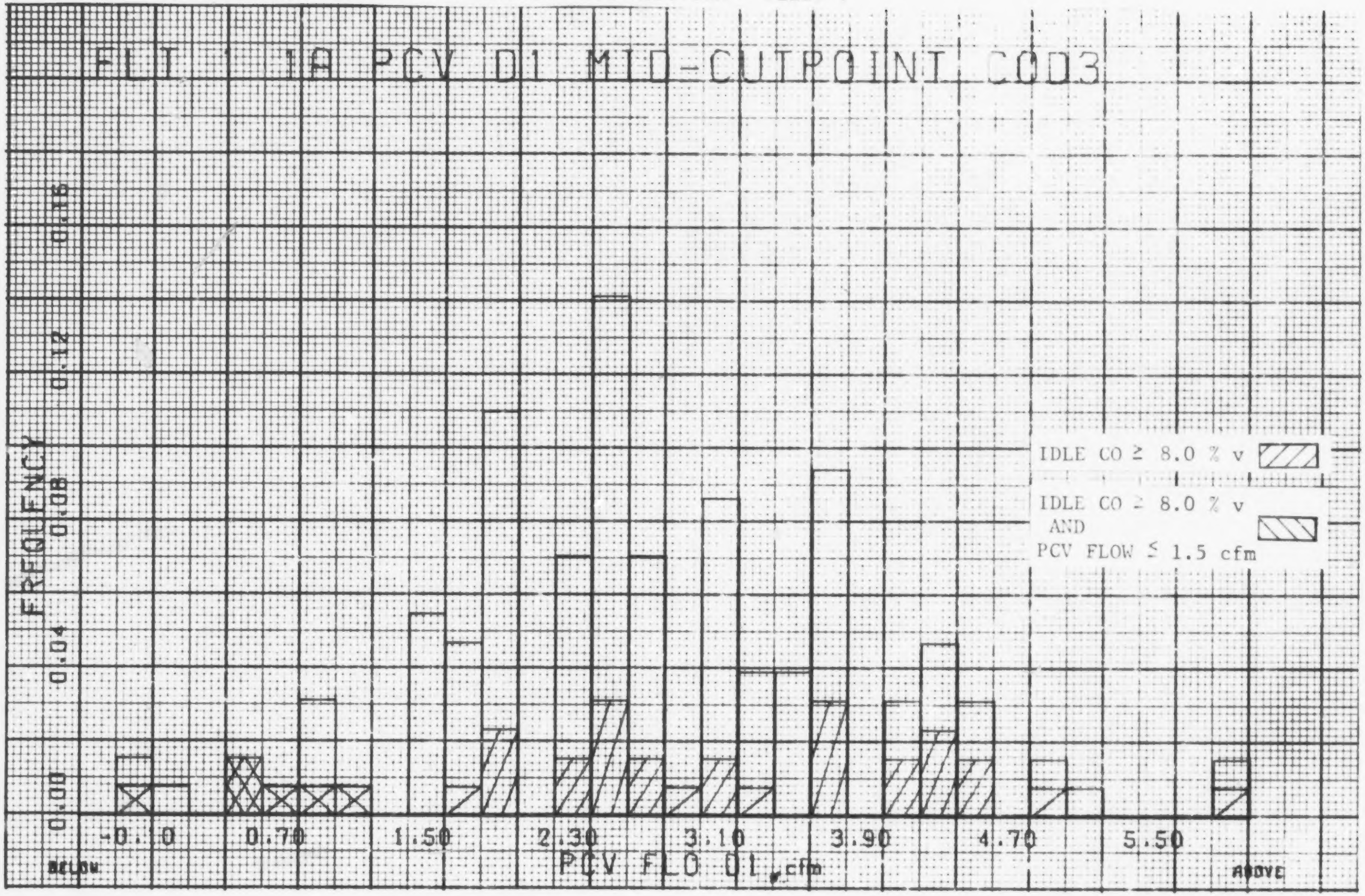

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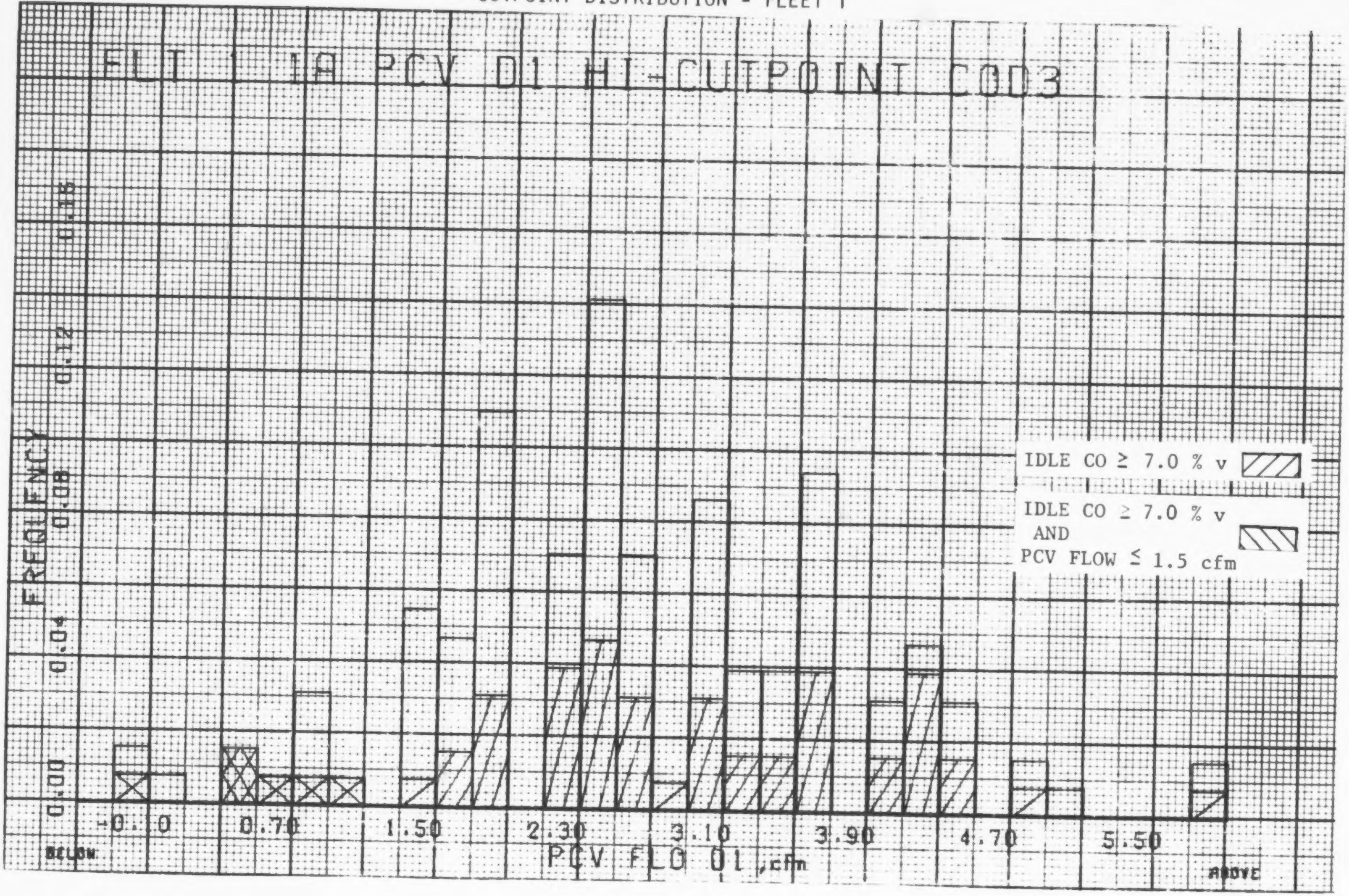
CUTPOINT DISTRIBUTION - FLEET 1



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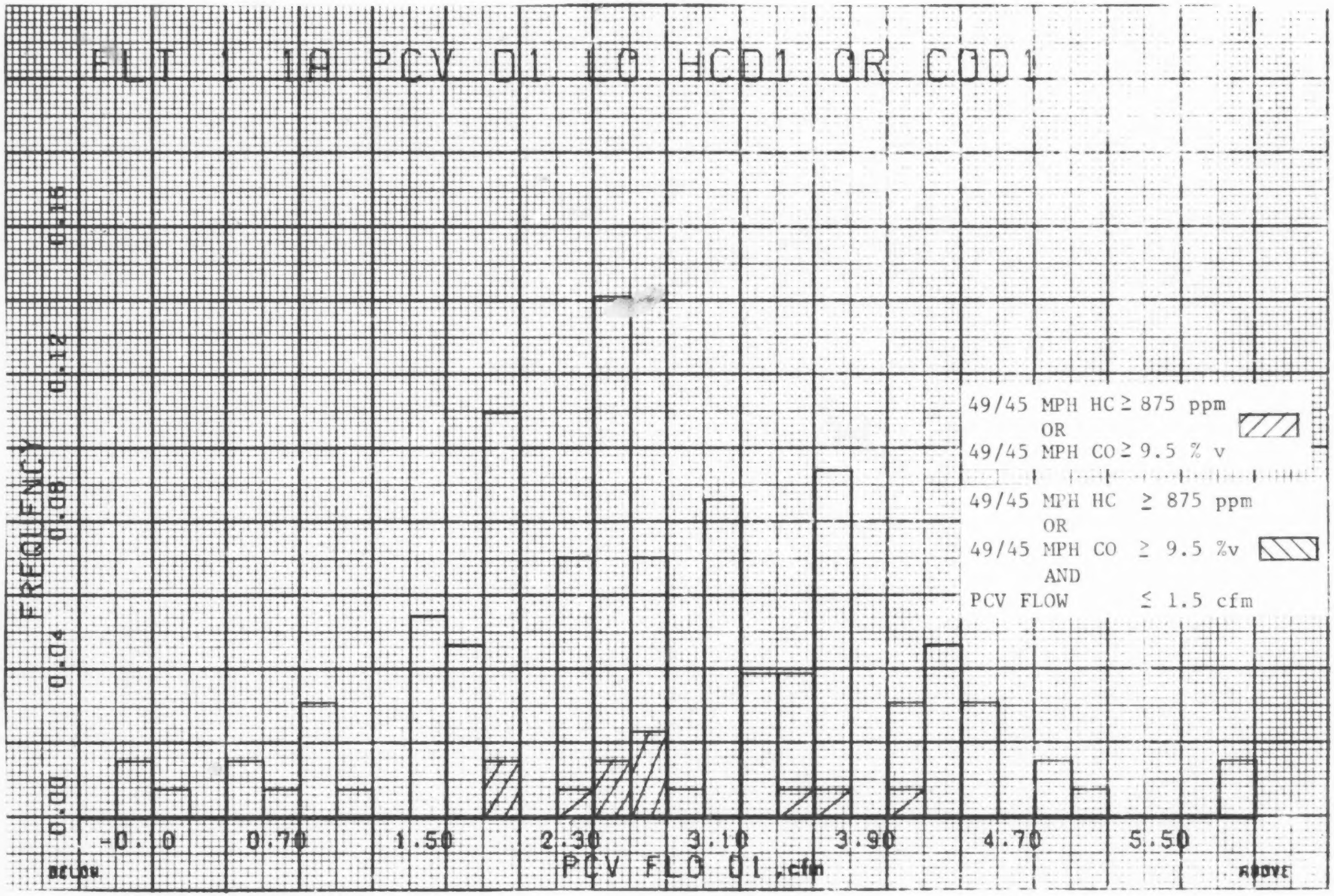
CUTPOINT DISTRIBUTION - FLEET 1



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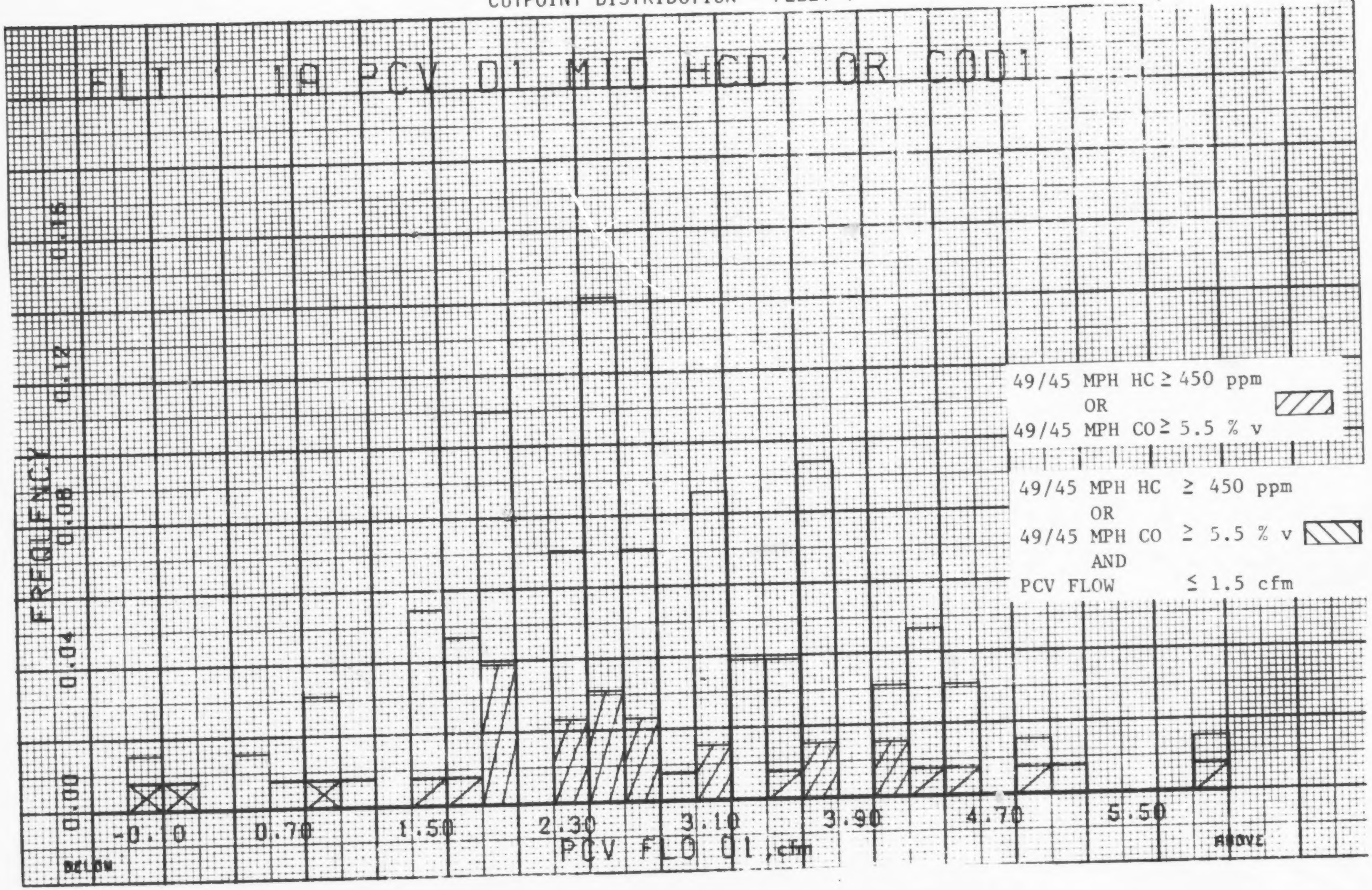

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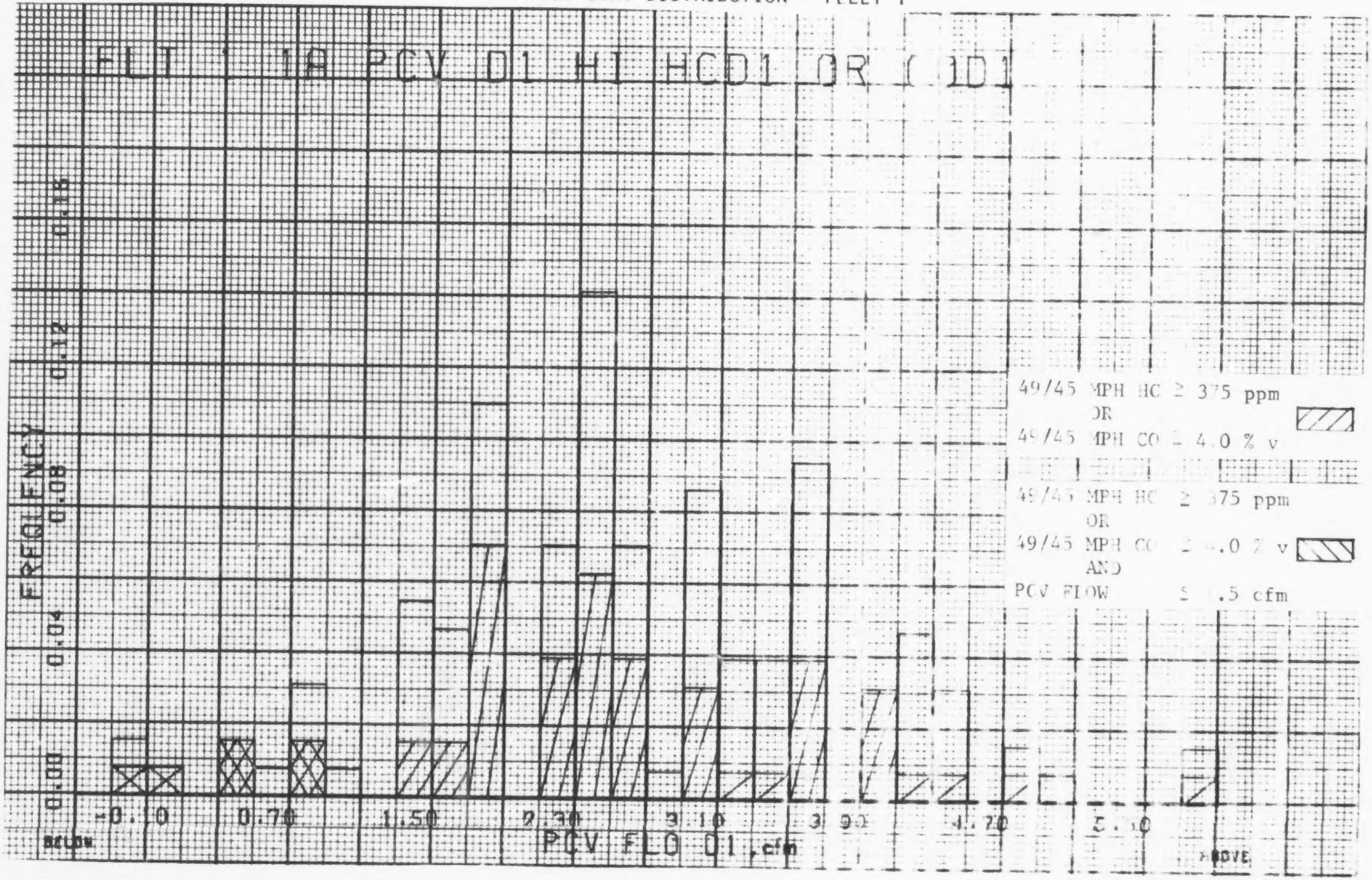

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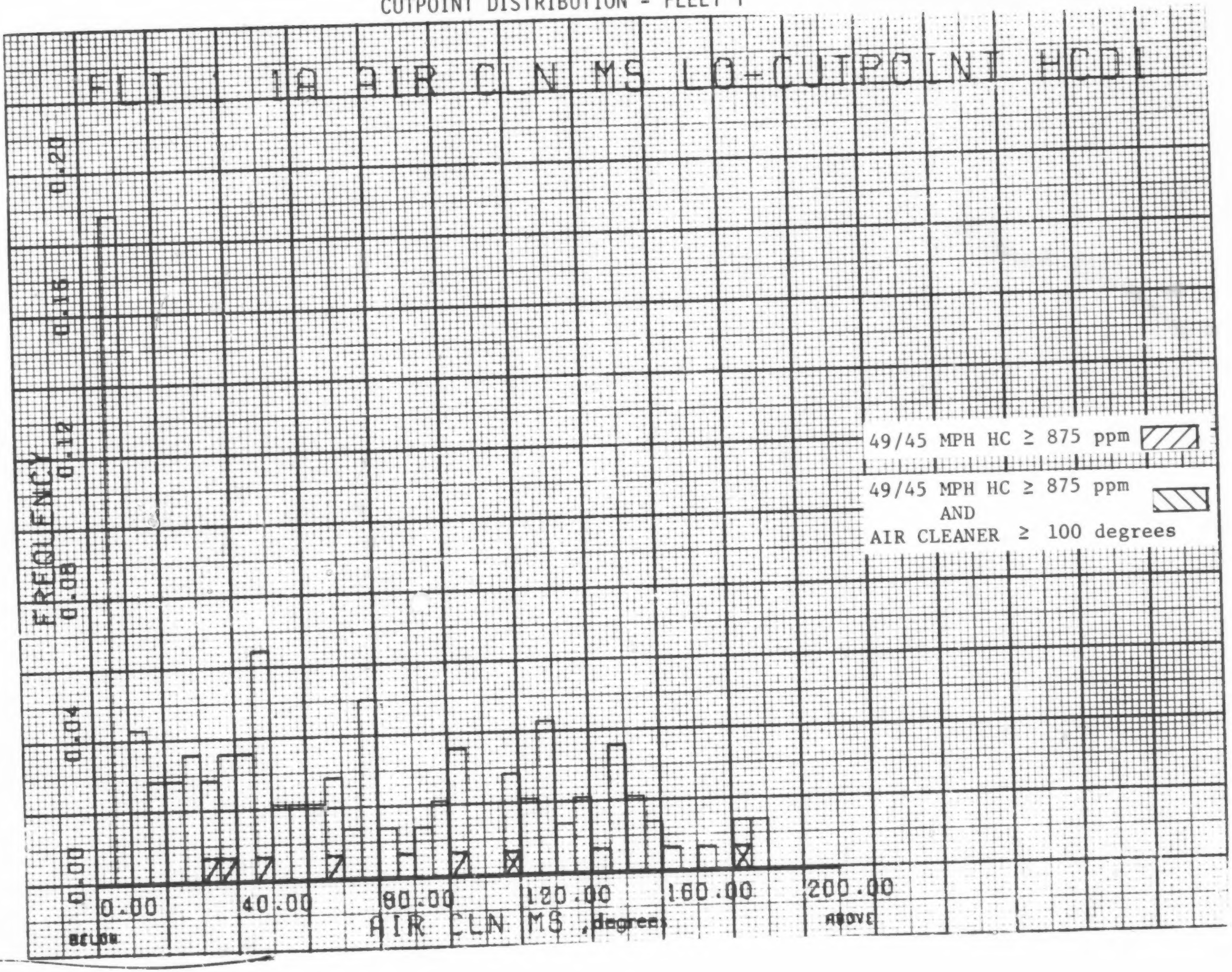

FIGURE 1

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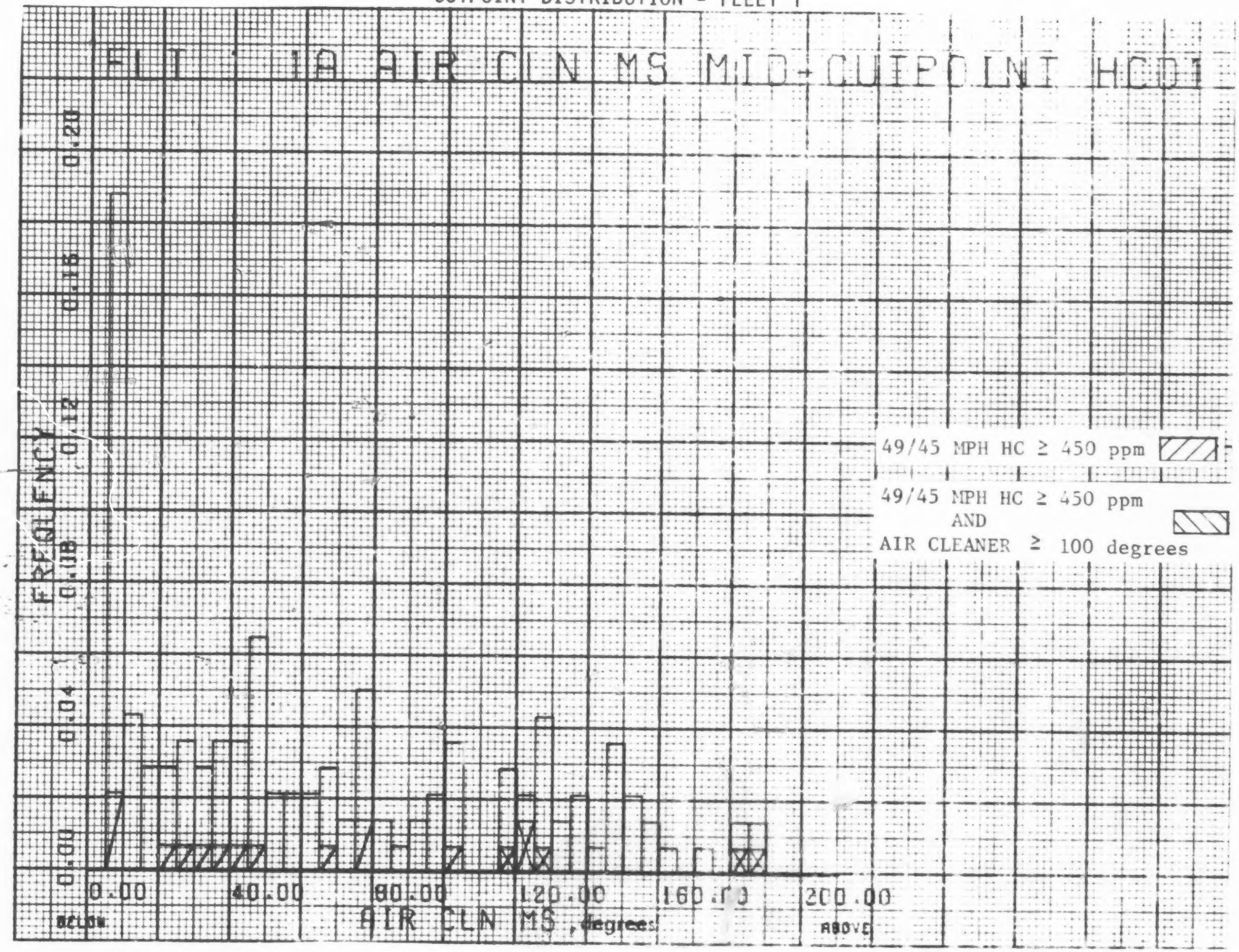

FIGURE 1

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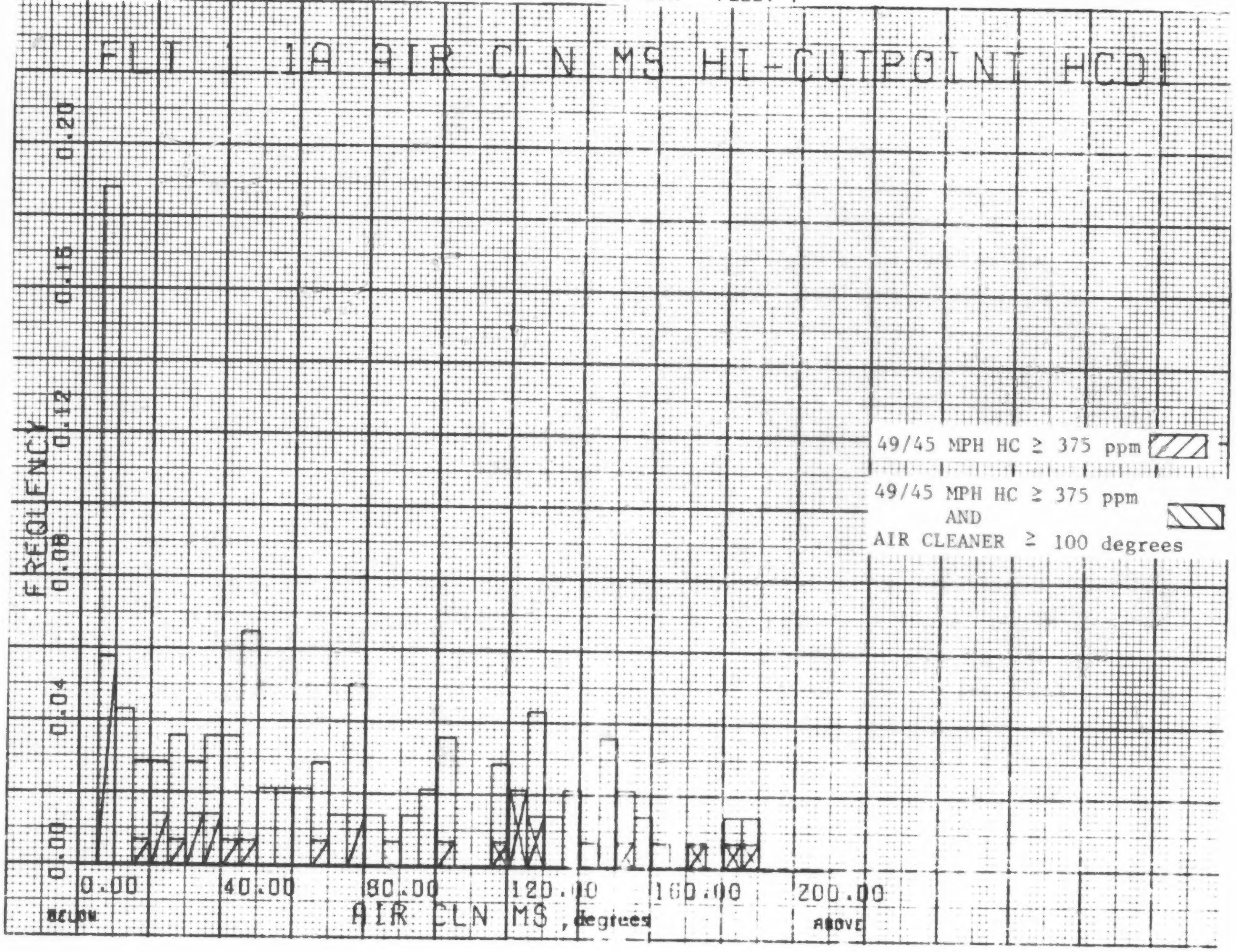

FIGURE 1

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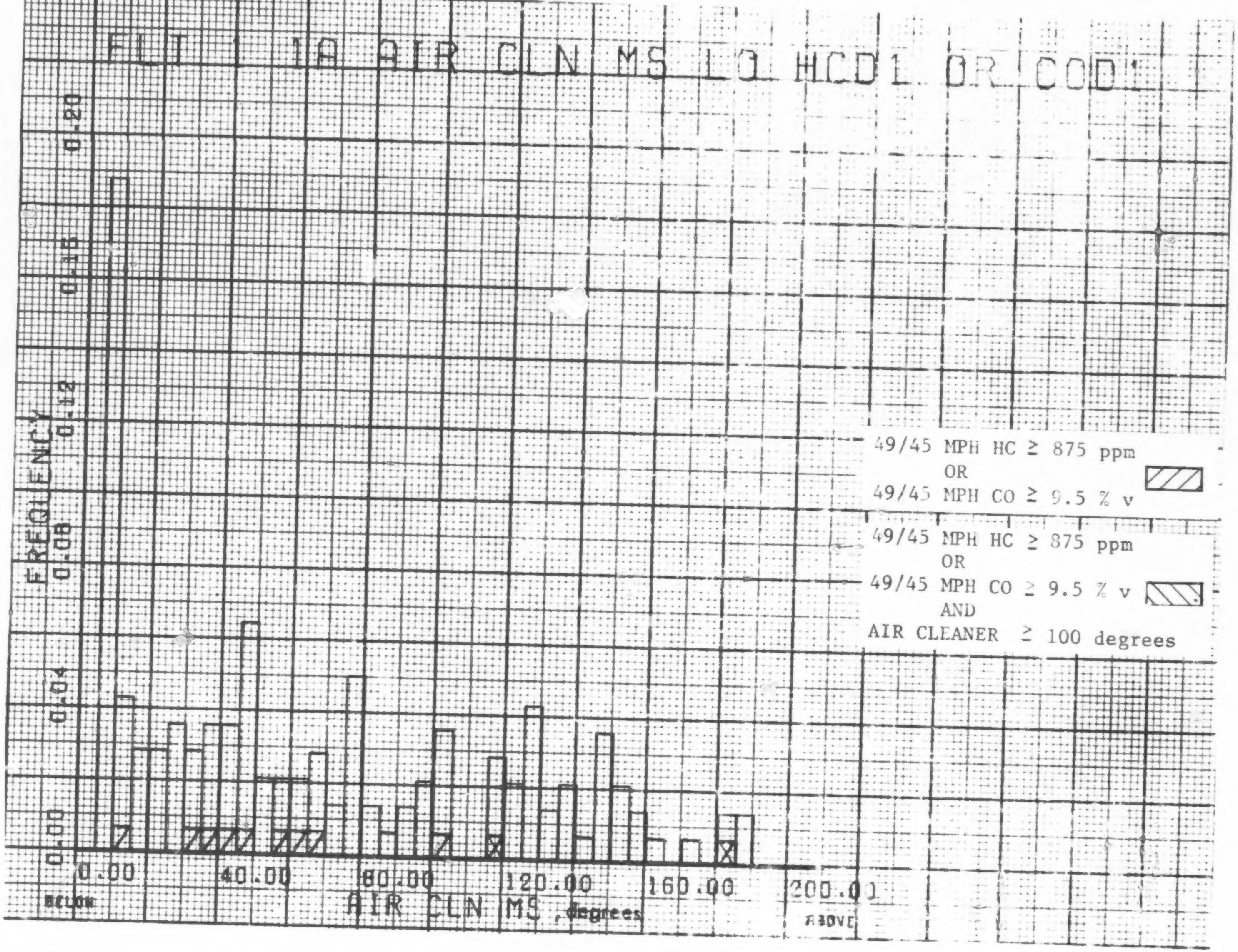

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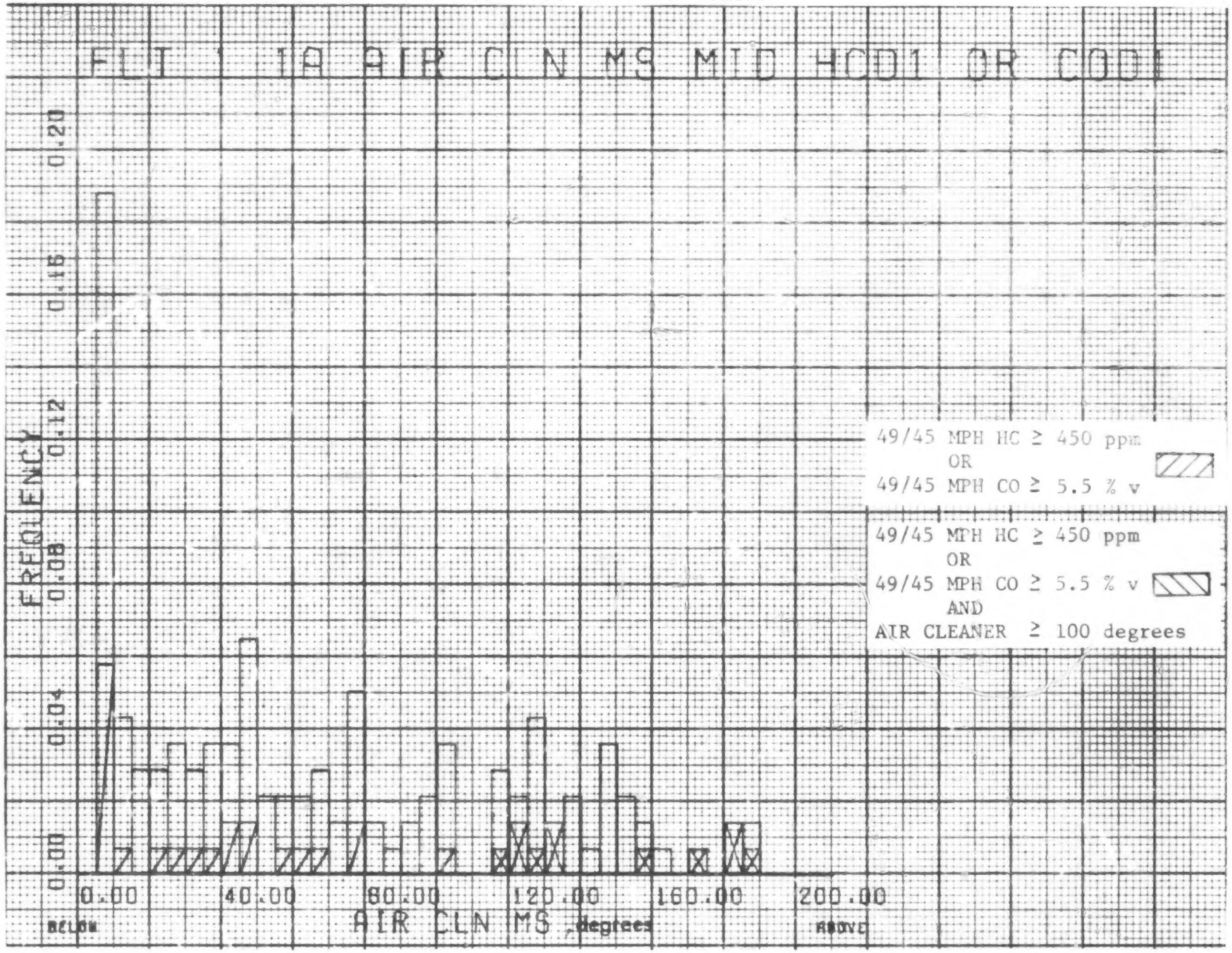

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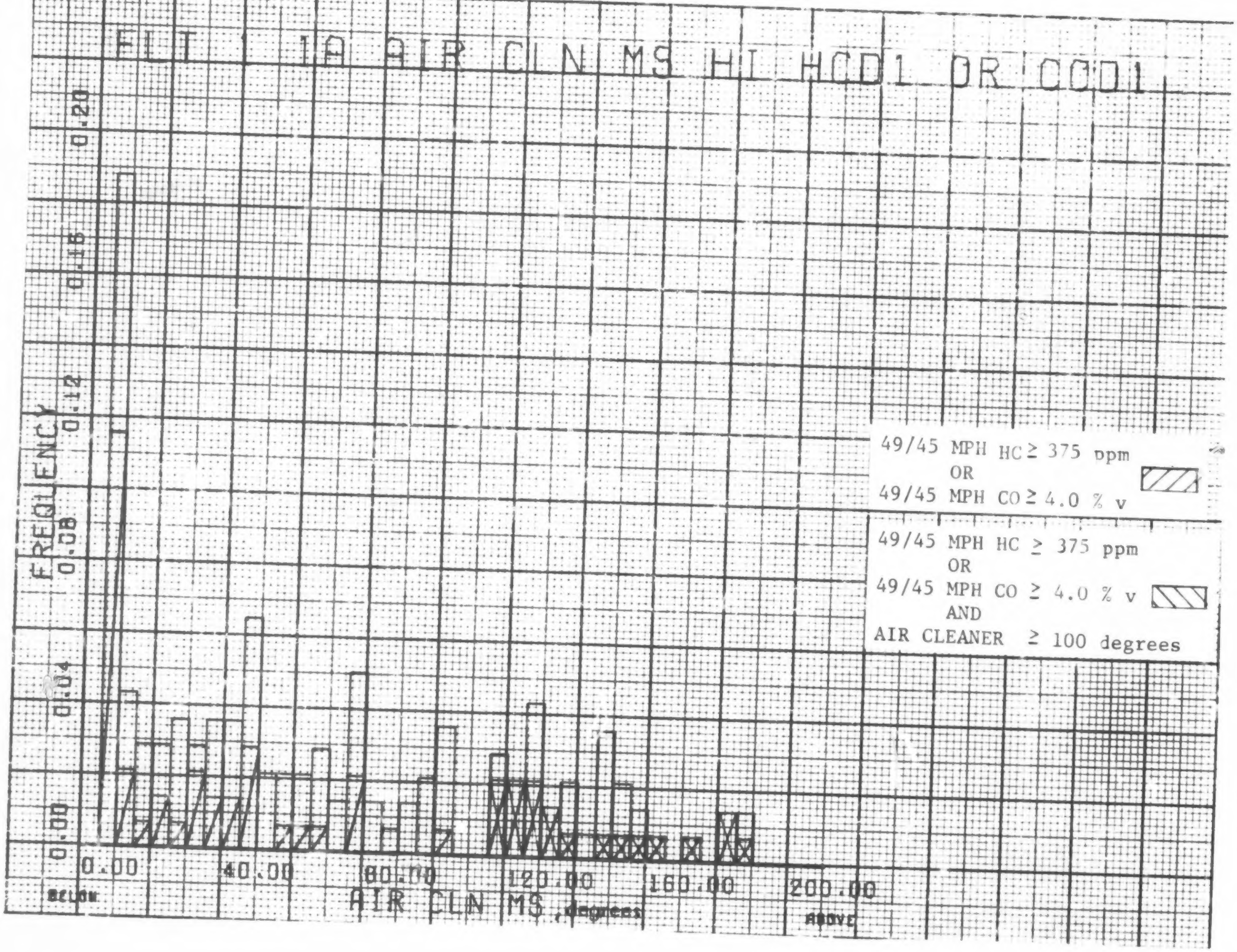


IGURE 2

CUTPOINT DISTRIBUTON - FLEET 2

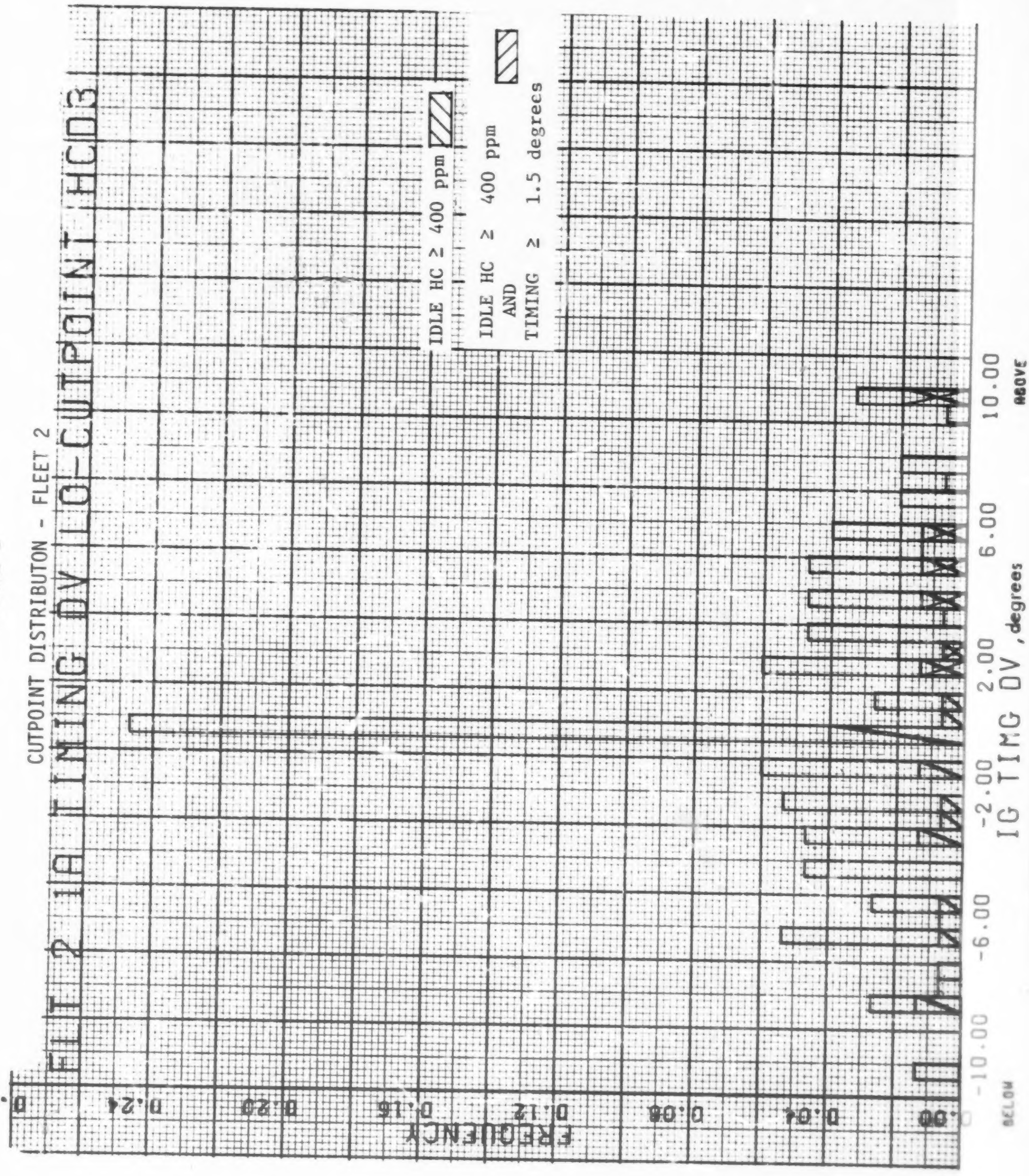


FIGURE 4.14

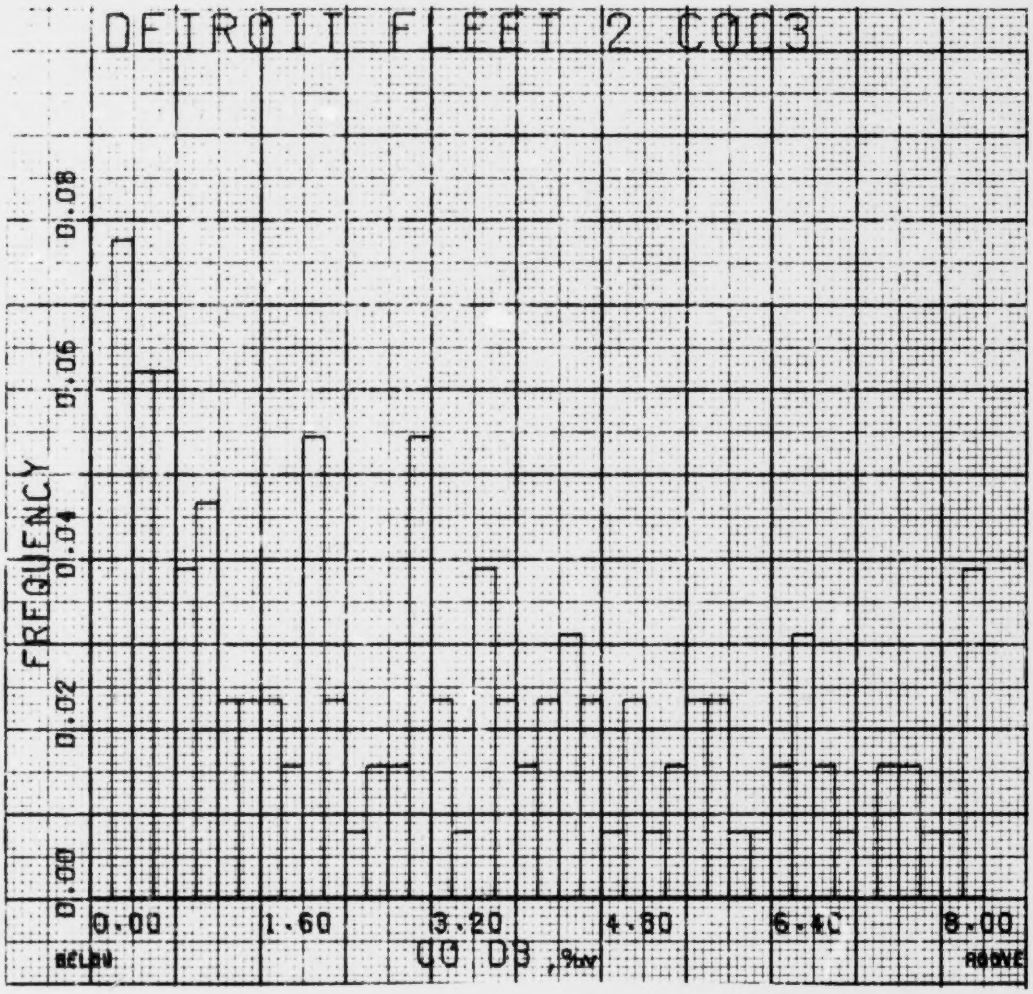

DETROIT FLEET 2 COD3
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.00
1.60
3.20
4.80
6.40
8.00
BELOW
ABOVE
CO DB ,%V

FIGURE 4.15

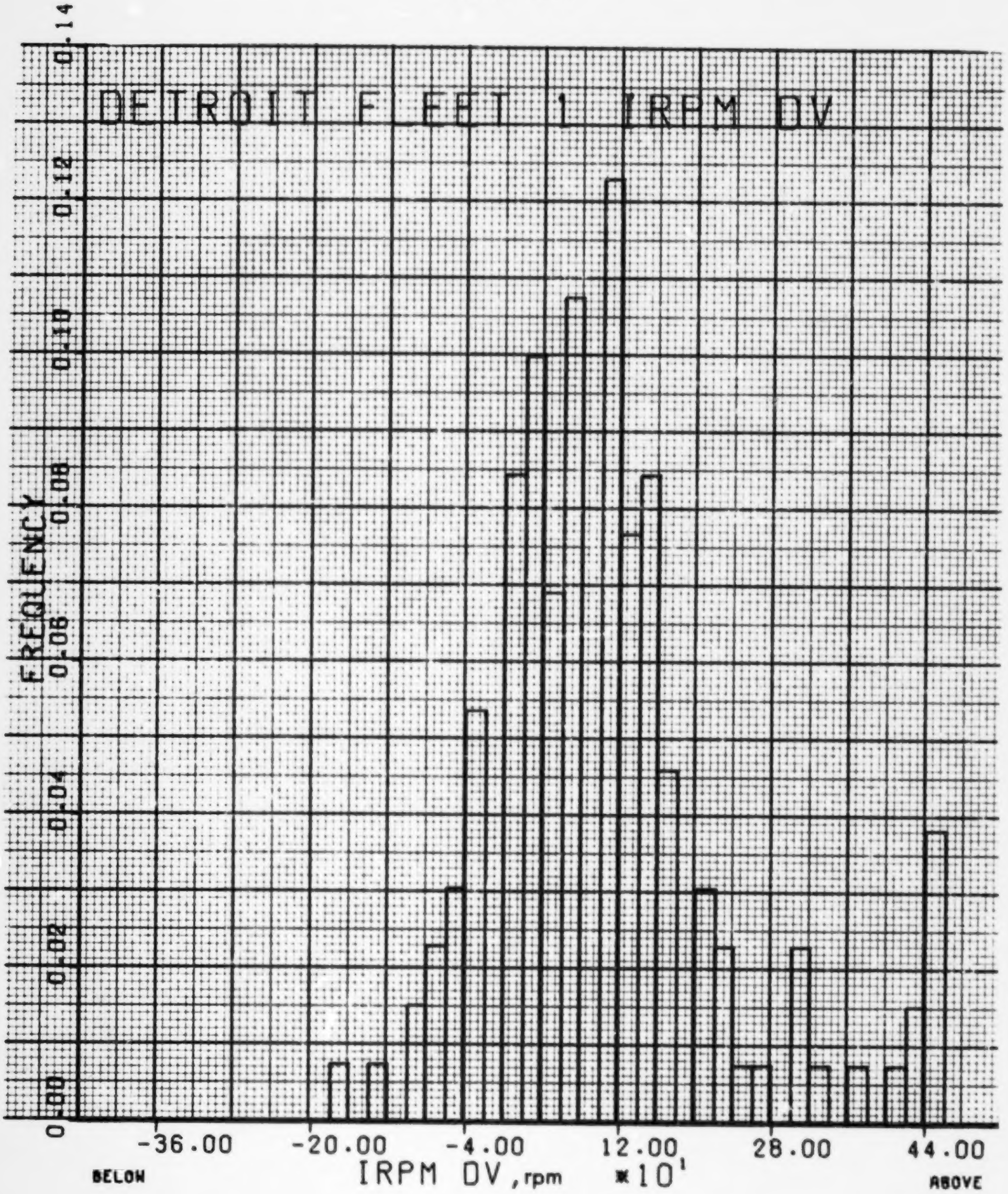

DETROIT FLEET 1 IRPM DV
FREQUENCY
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-36.00
-20.00
-4.00
12.00
28.00
44.00
BELOW
IRPM DV, rpm *10¹
ABOVE

FIGURE 4.16

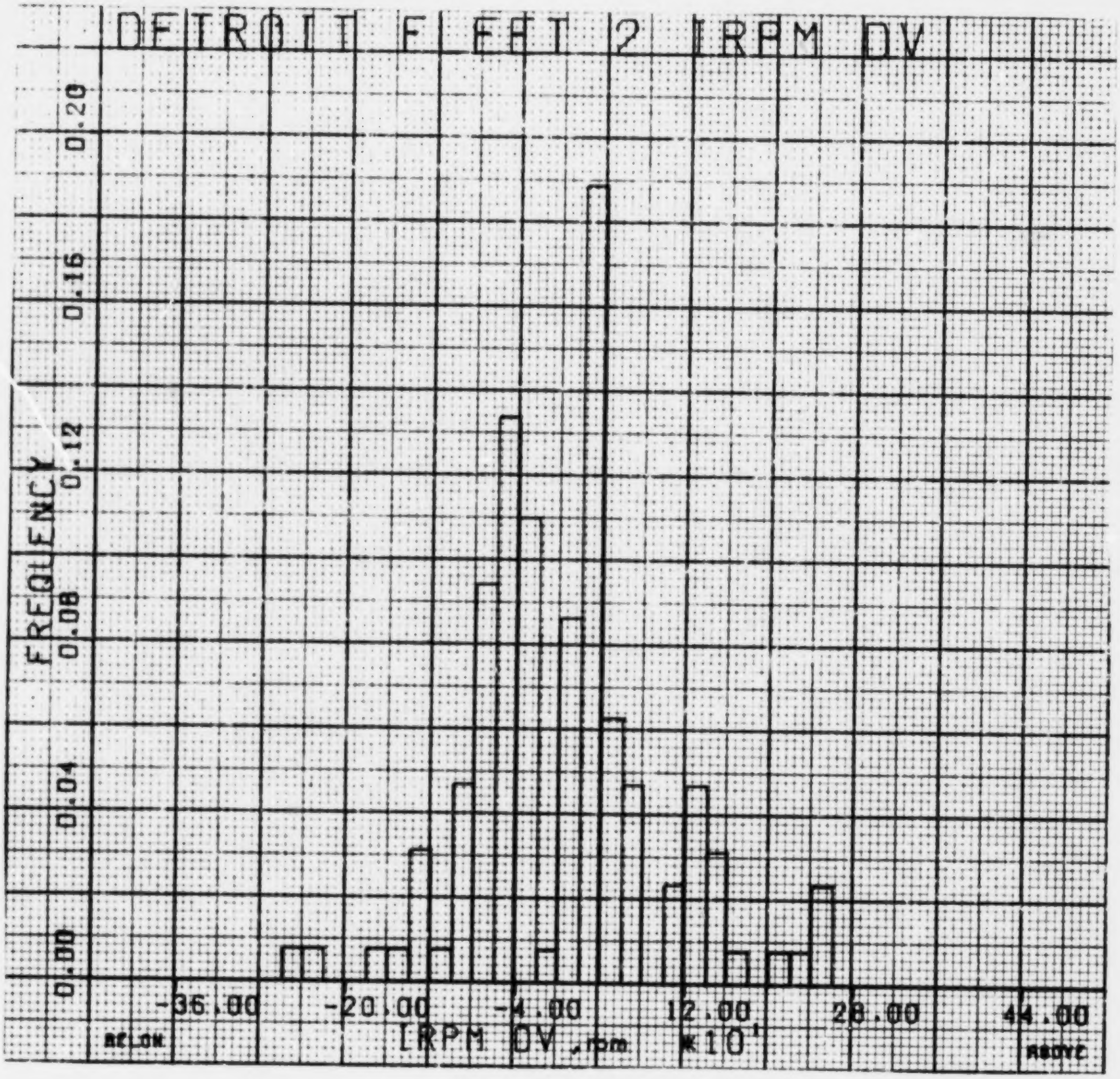

DETROIT F FAT 2 IRPM DV
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
-36.00
-20.00
-4.00
12.00
28.00
44.00
BELOW
ABOVE
IRPM DV ,rpm *10'

FIGURE 4.17

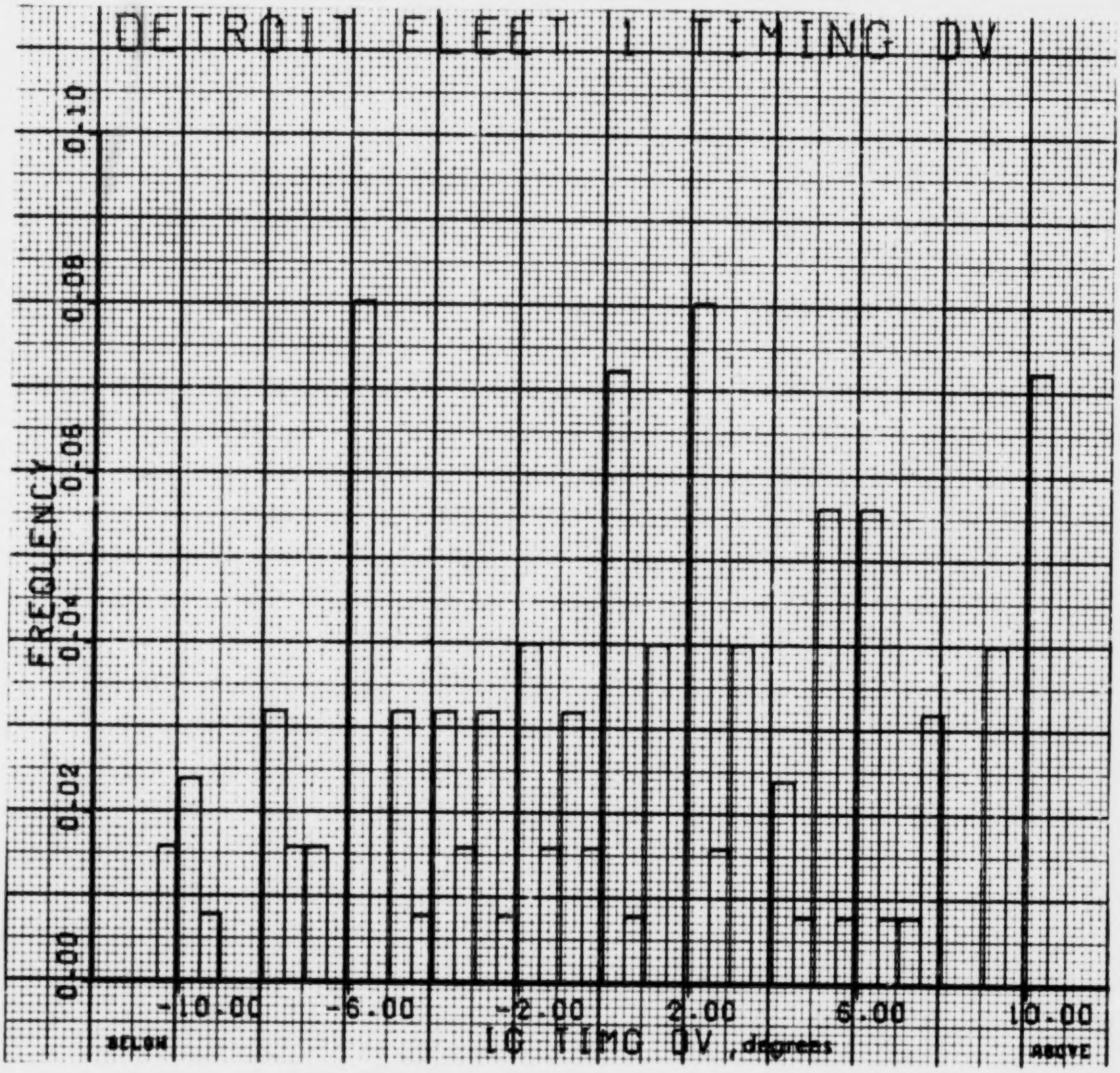

DETROIT FLEET 1 TIMING DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
-10.00
-6.00
-2.00
2.00
6.00
10.00
BELOW
ABOVE
IG TIMG DV , degrees

FIGURE 4.18

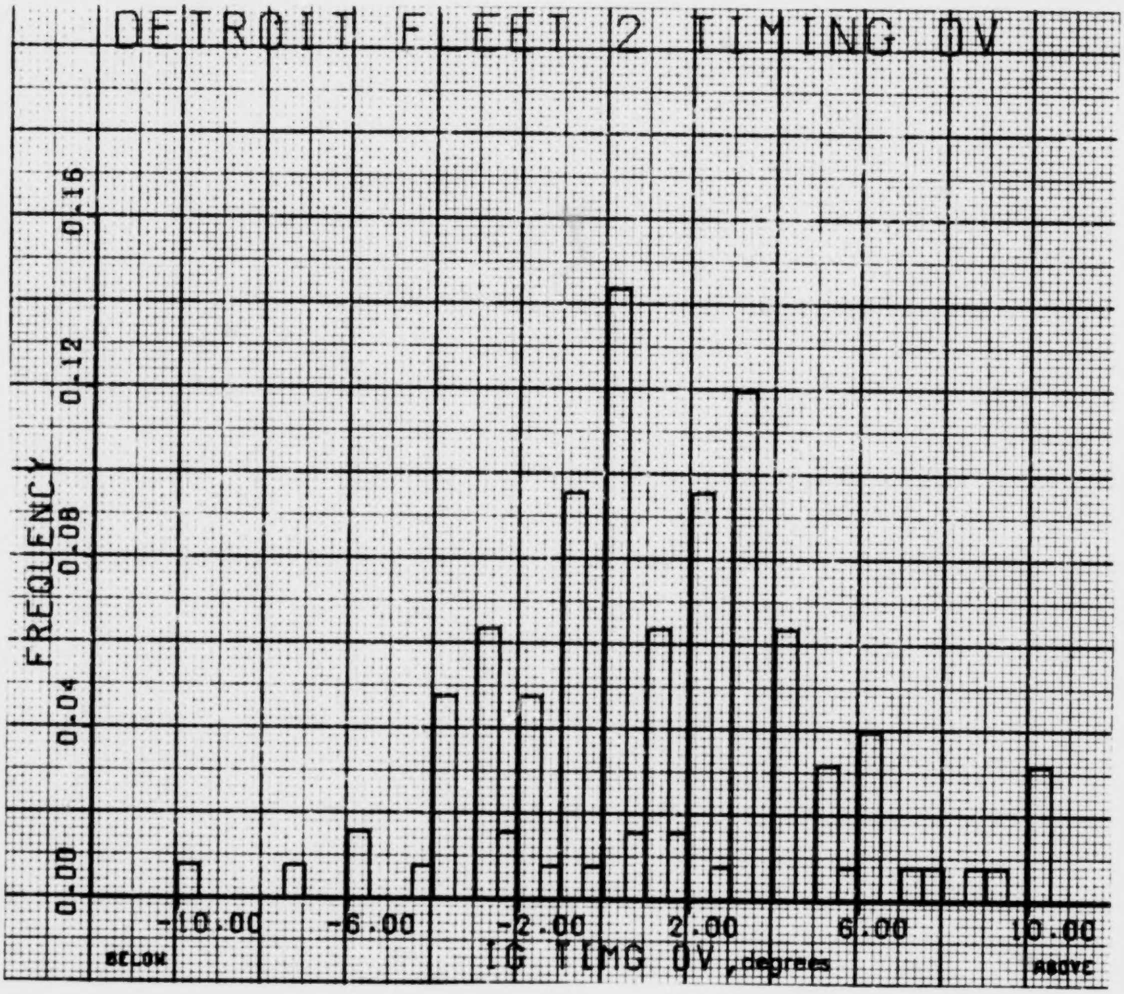

DETROIT FLEET 2 TIMING OV
FREQUENCY
0.00
0.04
0.08
0.12
0.16
-10.00
-6.00
-2.00
2.00
6.00
10.00
BELOW
ABOVE
IG TIMG OV, degrees

FIGURE 4.19

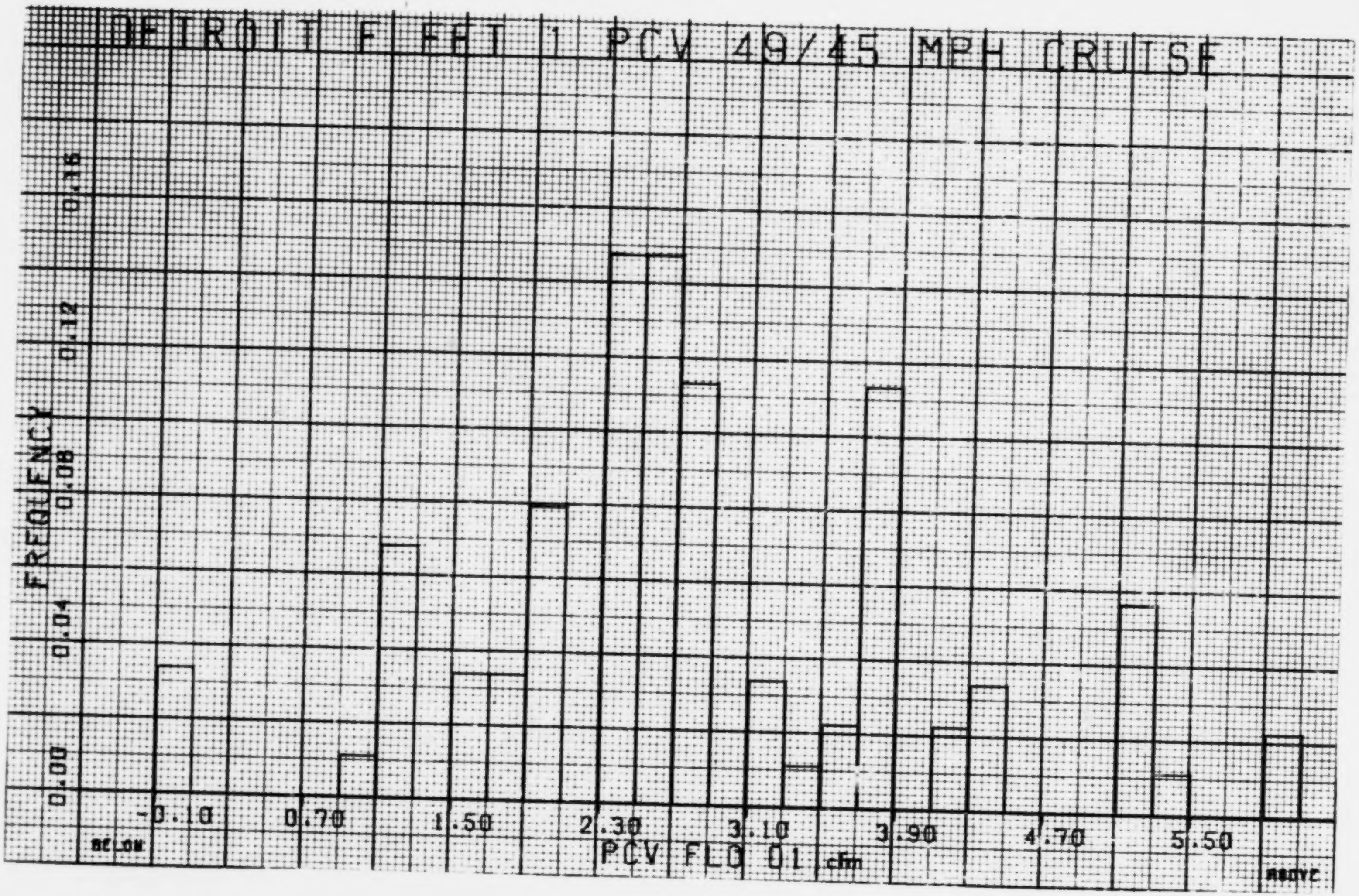

DETROIT F FET 1 PCV 40/45 MPH CRUISE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
BELOW
-0.10
0.70
1.50
2.30
3.10
3.90
4.70
5.50
ABOVE
PCV FLO 01 cfm

FIGURE 4.20

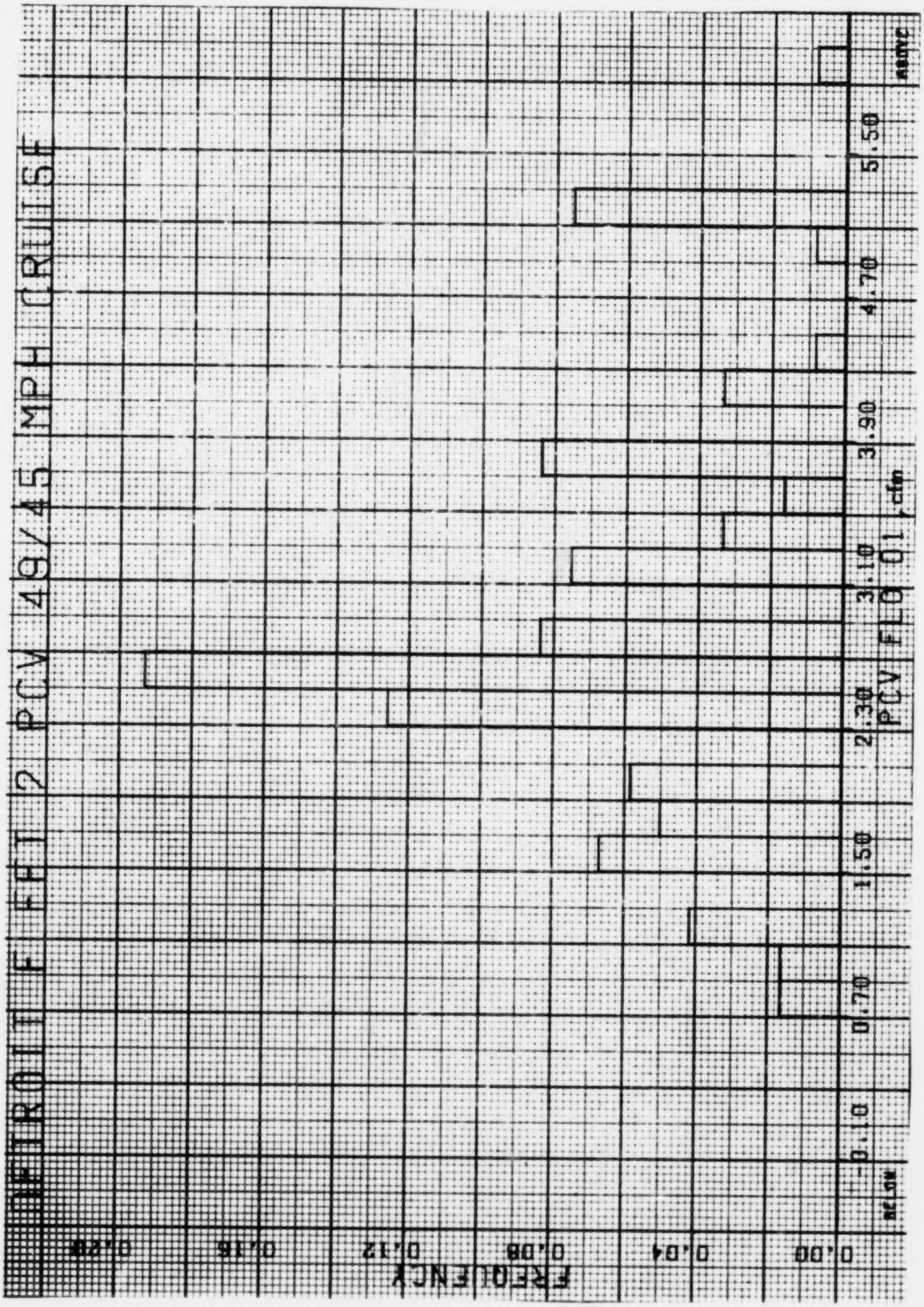

DETROIT F FHT 2 PCV 49/45 MPH CRUISE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
BELOW
-0.10
0.70
1.50
2.30
3.10
3.90
4.70
5.50
ABOVE
PCV FLO 01, cfm

FIGURE 4.21

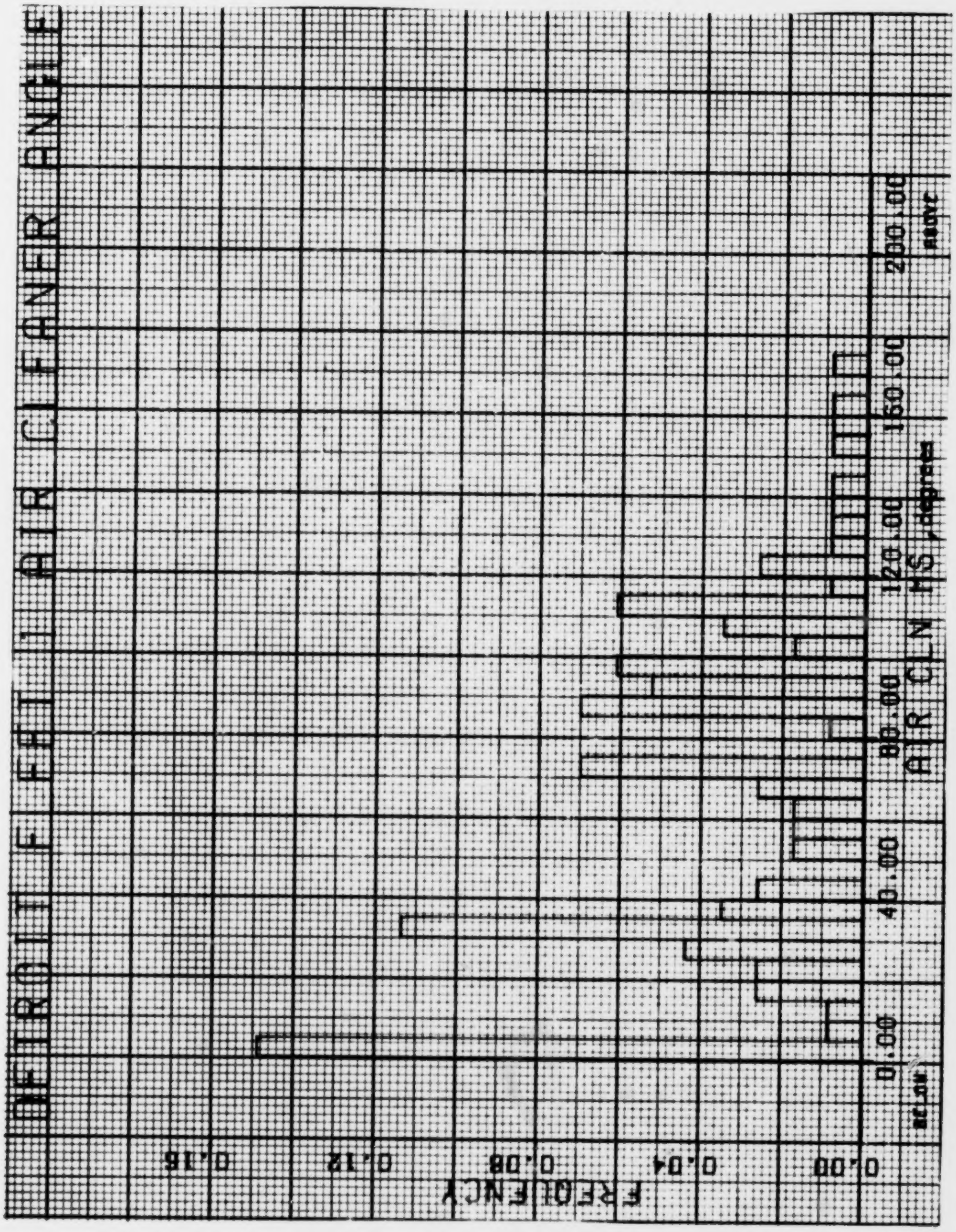

DETROIT FAT 1 AIR CLEANER ANGLE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
BELOW
0.00
40.00
80.00
120.00
160.00
200.00
ABOVE
AIR CLN HS, degrees

FIGURE 4.22

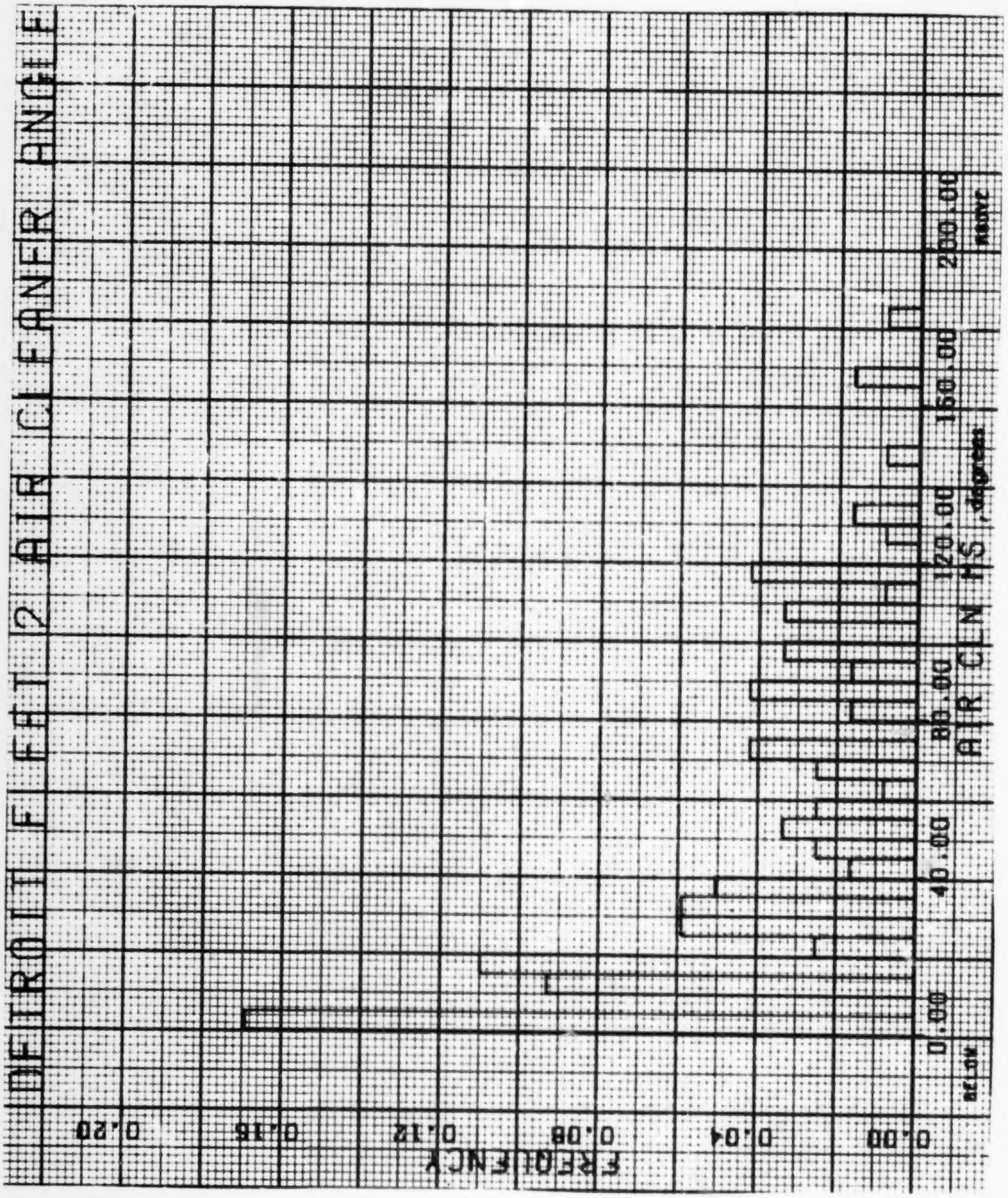

DETROIT FLEET 2 AIR CLEANER ANGLE
FREQUENCY
0.00
0.04
0.08
0.12
0.16
0.20
BELOW
0.00
40.00
80.00
120.00
160.00
200.00
ABOVE
AIR CLN HS, degrees

FIGURE 4.23

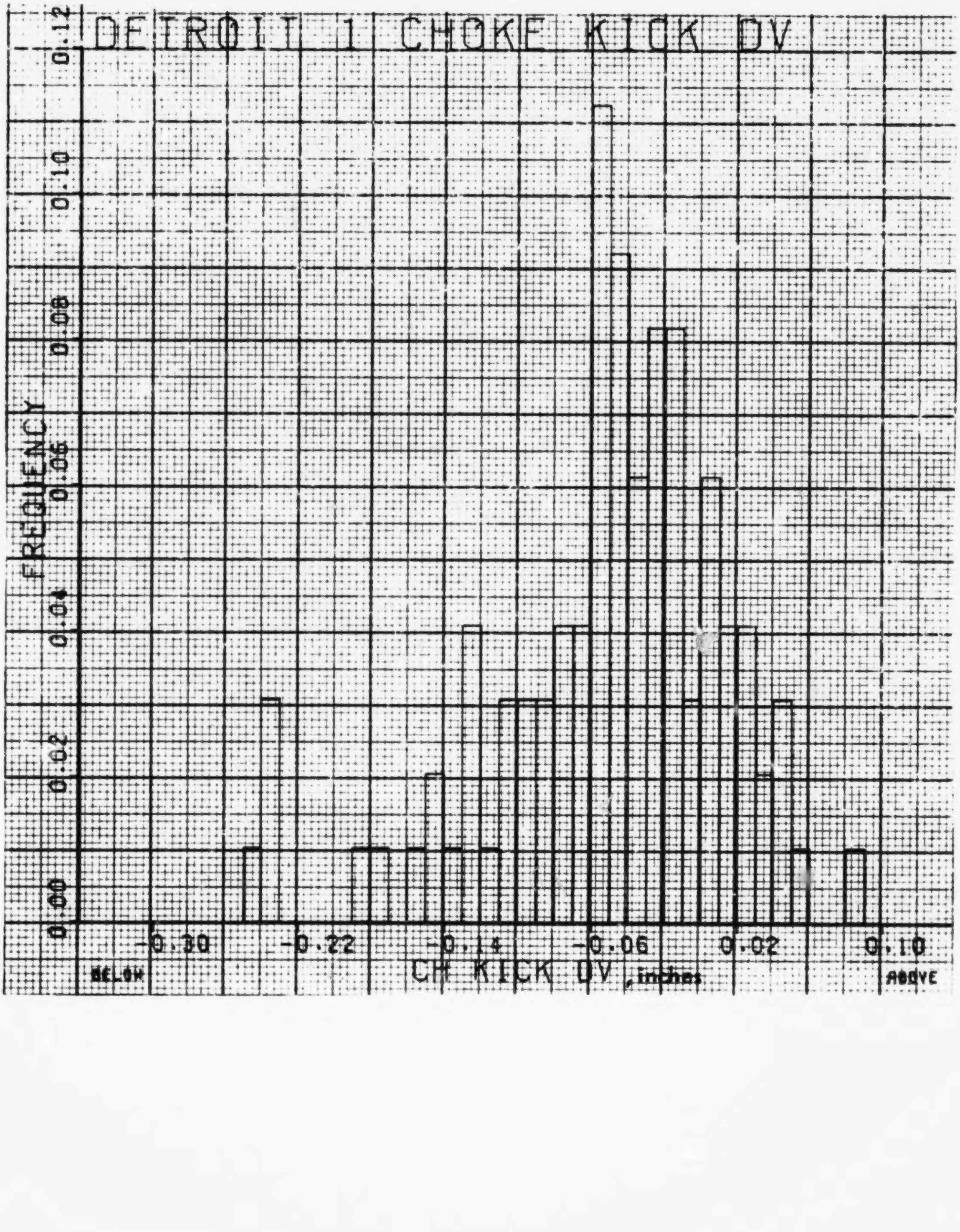
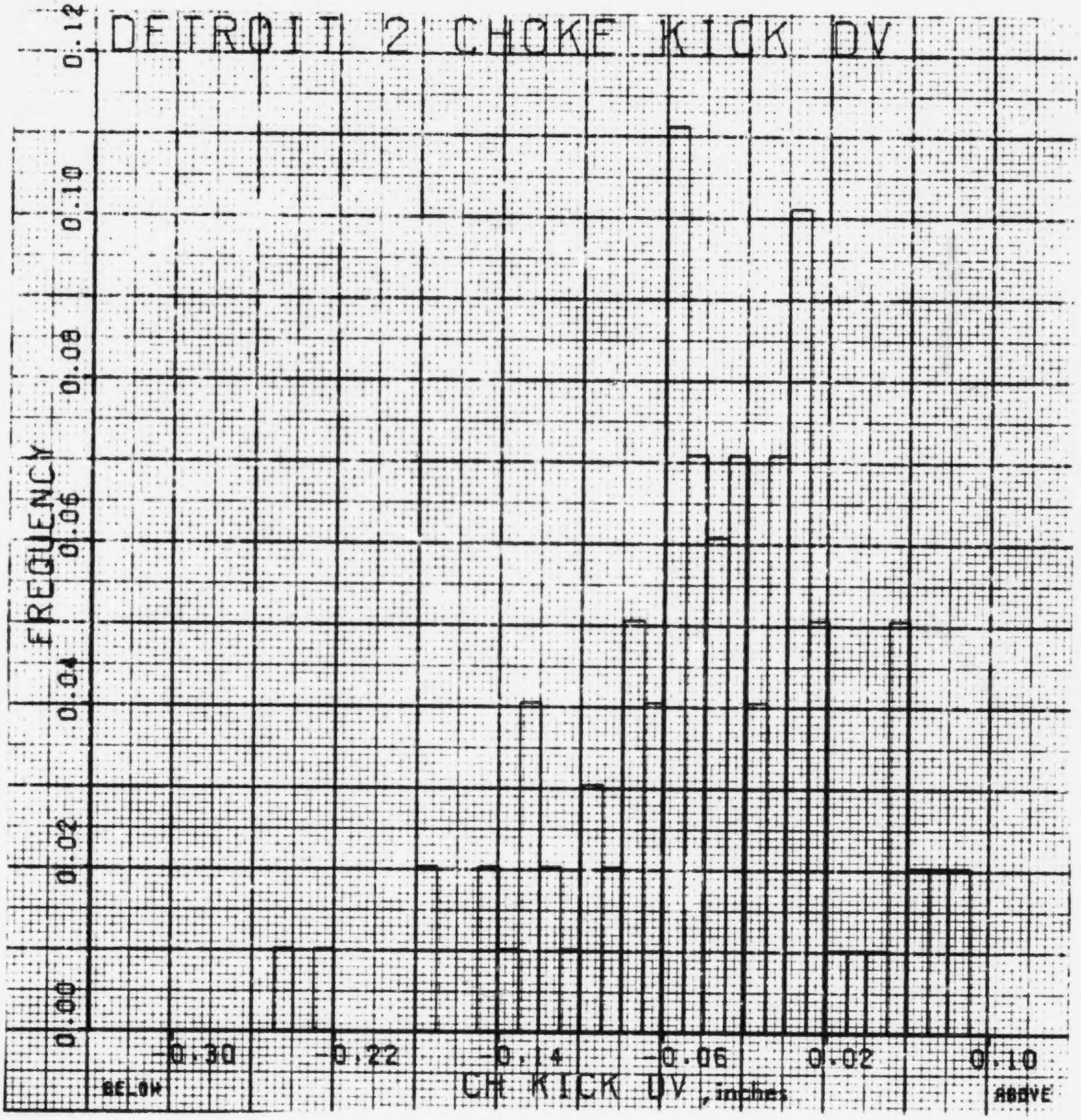

DETROIT 1 CHOKE KICK DV
FREQUENCY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
-0.30
-0.22
-0.14
-0.06
0.02
0.10
BELOW
CH KICK DV ,inches
ABOVE

FIGURE 4.24


DETROIT 2 CHOKE KICK DV
FREQUENCY
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.30
-0.22
-0.14
-0.06
0.02
0.10
BELOW
CH KICK DV ,inches
ABOVE

a log-normal distribution (Figures 4.21 and 4.22). The distributions of choke kick deviations are approximated with normal distributions but Figures 4.23 and 4.24 clearly illustrate skewed distribution toward larger values. These histograms, although skewed in some cases, suggest that preliminary trends can be established with standard statistical tests. This approach is consistent also with that used in the analysis of the California data, Section 2.

4.5 REGIONAL COMPARISON OF VEHICLE EMISSIONS AND ENGINE PARAMETERS

Vehicle maintenance states were first contrasted between Detroit and San Bernardino for each of the similar vehicle fleets sorted by emission control type. The results of this analysis, estimates of the mean ($\overline{X}$), standard deviation (S) and degrees of freedom (d.f.), are presented in Table 4.2. A statistical comparison of the emission and engine parameters using student "t" tests indicate that there are a few cases of statistically significant mean differences at the 90 percent confidence level. The carbon monoxide levels measured in the high cruise and idle modes are higher in San Bernardino vehicle fleets. The deviation of the choke kick from the specification value had richer setting in Detroit. The lower exhaust emissions in Detroit may be the result of a combination of newer, more advanced emission control equipment, basic engine changes and lower mileage accumulation.

The lower frequency and level of misfire, substantially explains the lower HC emissions; however, the induction related malfunctions affecting CO are not substantially different.

In order to determine whether or not mileage and model year effects were causing the differences observed in the emission and engine tune parameters, the vehicle fleet in Detroit was partitioned by California model year rather than emission control type. These comparisons show that only CO keymode emissions for the 1960-1965 vehicles were significantly different. The Detroit vehicles tended to again have lower CO emissions, but the mileage accumulations of the Detroit fleet vehicles were still markedly less than the San Bernardino vehicles. The higher HC emissions of California vehicles are probably explained by the higher frequency of ignition misfire (Table 4.2).

TABLE 4.2

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES							EMISSION CONTROLLED VEHICLES							NOX CONTROLLED VEHICLES		
	SAN BERNARDINO (1960-1965)			DETROIT (1960-1967)				SAN BERNARDINO (1966-1970)			DETROIT (1968-1971)				SAN BERNARDINO (1971)		
	$\overline{X}$	S	d.f.	$\overline{X}$	S	d.f.	t	$\overline{X}$	S	d.f.	$\overline{X}$	S	d.f.	t	$\overline{X}$	S	d.f.
HC 72 COLD, g/mile	12.00	7.0	147	-	-	-	-	7.25	5.7	149	-	-	-	-	4.44	1.8	149
CO 72 COLD, g/mile	131.5	63	147	-	-	-	-	86.9	46	149	-	-	-	-	63.4	37	149
NOX 72 COLD, g/mile	3.97	2.0	147	-	-	-	-	6.33	2.6	149	-	-	-	-	5.95	2.0	149
HC D1 (49/45), ppm	383	450	147	332	374	129	1.02	222	306	148	198	107	128	0.84	135	56	149
CO D1 (49/45), % v	3.43	2.6	147	1.64	1.5	129	7.13*	1.22	1.3	149	0.69	0.81	128	4.03*	0.67	1.16	149
NOX D1 (49/45), ppm	1666	864	147	-	-	-	-	2613	976	149	-	-	-	-	2537	740	149
HC D3 (Idle), ppm	865	989	146	603	582	128	2.64*	376	546	148	300.	230	128	1.55	240	199	149
CO D3 (Idle), % v	6.08	3.0	147	4.50	3.1	129	4.41*	4.09	2.6	149	3.15	2.5	128	3.08*	3.34	2.7	149
NOX D3 (Idle), ppm	126.8	122	147	-	-	-	-	124.2	82	149	-	-	-	-	168	96	149
TIMING, degrees (DV)	0.35	5.7	148	0.62	6.0	123	-0.38	0.50	4.6	149	1.07	3.7	124	-1.11	0.17	3.4	147
IRPM, rpm (DV)	77.9	137	148	108.5	146	129	-1.81	-18.2	108	149	2.5	90	126	-1.72	-5.68	138	149
AIR CLN ANGLE, degrees	60.0	53	137	61.7	45	113	-0.27	45.6	53	137	47	44	117	-0.23	28.8	43	130
PCV FLO D1, cfm	2.87	1.3	126	2.86	1.3	87	0.05	2.62	0.97	138	2.85	1.2	118	-1.71	2.58	0.90	135
CHOKE KICK, in. (DV)	9.24×10^{-3}	4.88×10^{-2}	79	-.0511	0.0654	97	6.85	-4.42×10^{-3}	4.6×10^{-2}	122	-.0372	0.0643	98	4.43*	-9.56×10^{-3}	4.06×10^{-2}	126
HEAT RISER, % failed	53.1	-	80	68.0	-	77	-	44.0	-	74	42.5	-	65	-	3.4	-	29
VACUUM DIAPH, % failed	25.0	-	27	32.6	-	42	-	21.7	-	91	21.3	-	79	-	0.0	-	123
MISFIRE D1, %	12.3	11.3	6	14.5	1.8	4	-0.51	2.6	0.4	2	4.7	0.4	1	-5.75	-	-	-
MISFIRE D2, %	14.4	9.6	6	15.1	1.7	4	-0.18	4.6	3.6	2	4.8	2.4	1	-0.07	-	-	-
MISFIRE D3, %	17.5	12.0	6	13.9	3.8	4	0.74	11.5	9.7	2	4.2	0.9	1	1.30	-	-	-
AIR PUMP, % failed	-	-	-	-	-	-	-	20.0	-	34	-	-	-	-	-	-	-
NOX CONTROL, % failed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.9	-	81
MILEAGE, miles	83358	26047	148	58280	19377	129	-	43786	20567	148	27863	17340	128	-	8059	6451	149

*Estimates of means significantly different (confidence equal to or greater than 90%).

TABLE 4.3

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	PRE-EMISSION CONTROLLED VEHICLES						
	SAN BERNARDINO ([illegible])			DETROIT ([illegible])			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	12.80	7.8	147	—	—	—	—
CO 72 COLD, g/mile	131.5	67	147	—	—	—	—
NOX 72 COLD, g/mile	1.97	3.0	141	—	—	—	—
HC DI (AP/AT), ppm	383	258	147	368	409	73	0.36
CO DI (AP/AT), % v	3.47	1.8	147	3.65	1.9	73	3.46*
NOX DI (AP/AT), ppm	2446	864	141	—	—	—	—
HC DI (idle), ppm	863	984	146	631	594	73	1.87*
CO DI (idle), % v	6.08	3.0	147	4.27	3.7	73	4.24*
NOX DI (idle), ppm	126.8	122	141	—	—	—	—
TIMING, degrees (DV)	2.35	5.7	148	1.43	8.1	68	1.28
IRPM, rpm (DV)	17.9	137	148	100	155	73	2.07*
AIR CLN ANGLE, degrees	60.2	53	137	62.5	65	61	0.30
PCV FLO DI, cfm	1.87	1.1	126	1.48	1.1	34	1.56
CHOKE KICK, in (DV)	8.24×10^{-1}	4.88×10^{-1}	79	$[illegible]\times10^{-1}$	8.9×10^{-2}	35	4.20*
HEAT RISER, % failed	53.1	—	90	68.0	66.7	43	—
VACUUM DIAPH, % failed	11.8	—	17	32.6	60.0	14	—
MISFIRE D1, %	12.3	11.3	6	15.7	8.96	7	0.50
MISFIRE D2, %	16.5	9.8	6	15.6	3.8	7	0.17
MISFIRE D3, %	17.5	12.0	6	12.8	6.6	7	0.83
AIR PUMP, % failed	—	—	—	—	—	—	—
NOX CONTROL, % failed	—	—	—	—	—	—	—
MILEAGE, miles	81358	26067	148	62293	21775	73	—

*Estimates of means significantly different (confidence equal to or greater than 95%).

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	EMISSION CONTROLLED VEHICLES						
	SAN BERNARDINO (1966-1970)			DETROIT (1966-1970)			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	7.23	5.1	149	—	—	—	—
CO 72 COLD, g/mile	86.8	48	149	—	—	—	—
NOX 72 COLD, g/mile	4.33	1.8	149	—	—	—	—
HC DI (AP/AT), ppm	321	308	148	244	220	156	0.73
CO DI (AP/AT), % v	1.37	1.3	149	1.00	1.2	156	1.55
NOX DI (AP/AT), ppm	29.1	876	149	—	—	—	—
HC DI (idle), ppm	370	346	148	408	490	155	-2.58
CO DI (idle), % v	4.06	2.6	149	3.93	2.9	156	0.51
NOX DI (idle), ppm	124.2	91	109	—	—	—	—
TIMING, degrees (DV)	0.50	4.4	149	0.41	4.7	152	0.06
IRPM, rpm (DV)	-19.2	106	149	78.1	114	155	-1.70*
AIR CLN ANGLE, degrees	42.8	33	137	53.1	65	146	-1.32
PCV FLO DI, cfm	2.62	0.91	148	2.98	1.7	148	-2.78*
CHOKE KICK, in (DV)	-4.47×10^{-1}	4.6×10^{-2}	127	-43.1×10^{-1}	$[illegible]\times10^{-2}$	119	3.43*
HEAT RISER, % failed	44.5	—	74	54.9	—	92	—
VACUUM DIAPH, % failed	11.7	—	91	74.1	—	91	—
MISFIRE D1, %	3.42	2.6	3	8.7	4.6	3	-2.29
MISFIRE D2, %	0.19	3.6	3	9.2	6.0	3	-1.29
MISFIRE D3, %	0.64	8.1	3	9.8	6.6	3	0.28
AIR PUMP, % failed	20.0	—	36	—	—	—	—
NOX CONTROL, % failed	—	—	—	—	—	—	—
MILEAGE, miles	43786	20347	149	60420	27523	156	—

*Estimates of means significantly different (confidence equal to or greater than 95%).

COMPARISON OF SAN BERNARDINO AND DETROIT VEHICLE PARAMETER DISTRIBUTIONS

PARAMETERS	NO_x CONTROLLED VEHICLES						
	SAN BERNARDINO (1971)			DETROIT (1971)			
	$\bar{x}$	s	d.f.	$\bar{x}$	s	d.f.	t
HC 72 COLD, g/mile	4.43	1.8	149	—	—	—	—
CO 72 COLD, g/mile	61.5	37	149	—	—	—	—
NOX 72 COLD, g/mile	3.95	2.0	149	—	—	—	—
HC DI (AP/AT), ppm	135	56	149	168	72	21	-2.51
CO DI (AP/AT), % v	0.87	1.2	149	0.90	1.0	21	0.26
NOX DI (AP/AT), ppm	2517	760	149	—	—	—	—
HC DI (idle), ppm	247	199	149	217	176	21	1.28
CO DI (idle), % v	3.36	2.3	149	2.06	2.0	21	2.35
NOX DI (idle), ppm	168	96	149	—	—	—	—
TIMING, degrees (DV)	0.17	3.4	11	1.2	6.1	26	-1.90
IRPM, rpm (DV)	-5.68	138	149	61.9	105	25	-1.68
AIR CLN ANGLE, degrees	28.9	43	130	39.0	56	23	-1.07
PCV FLO DI, cfm	1.58	0.80	135	2.61	0.99	24	[illegible]
CHOKE KICK, in (DV)	-8.56×10^{-1}	4.08×10^{-2}	126	23.4×10^{-3}	3.9×10^{-2}	21	1.97
HEAT RISER, % failed	3.4	—	79	0	—	3	—
VACUUM DIAPH, % failed	3.3		123	4.25	—	16	—
MISFIRE D1, %	0		149	0	—	27	—
MISFIRE D2, %	0	—	149	0	—	27	—
MISFIRE D3, %	0	—	149	0	—	22	—
AIR PUMP, % failed	—	—	—	0	—	5	—
NOX CONTROL, % failed	4.9	—	81				
MILEAGE, miles	8059	6651	149	7720	5692	23	—

*Estimates of means significantly different (confidence equal to or greater than 95%).

In a comparison with the emission controlled vehicle fleets of the two cities in which the mileage accumulations were comparable, no statistical differences in the emission levels are indicated. Some significant differences of Idle RPM, PCV Valve flowrate (49/45 MPH Cruise) and the choke kick deviations were observed. These deviations are in the direction which would explain the somewhat higher CO emissions in the San Bernardino fleet. The slightly lower HC emissions in this fleet reflect a slightly lower frequency of misfire.

With the 1971 vehicles, the HC measurement of the 49/45 MPH Cruise and the CO measurement under the Idle Mode were found to be significantly different. As was the case in the previous comparison, the choke kick deviations for the fleets were significantly different. In general, however, the data indicate reasonable agreement in the distribution of the vehicles of the two cities. Some of the parameters such as Idle RPM which appeared to be set considerably higher in Detroit seem reasonable because of the colder climate. It was surprising, however, that there are equally large numbers of heat riser failures in the Detroit vehicle fleets as there were in the San Bernardino fleets.

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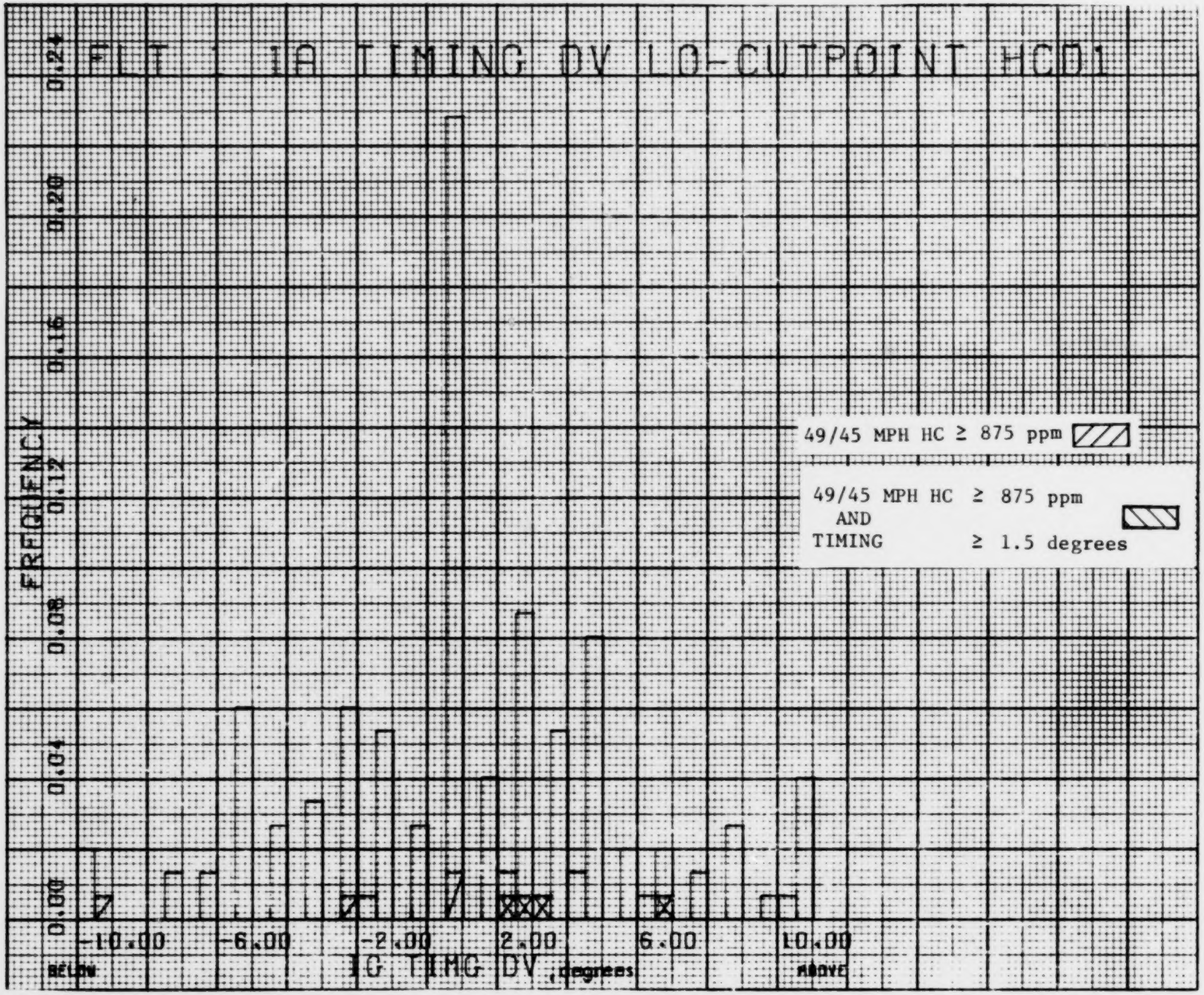
APPENDIX A

ENGINE PARAMETER DETERIORATION STUDY

FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1



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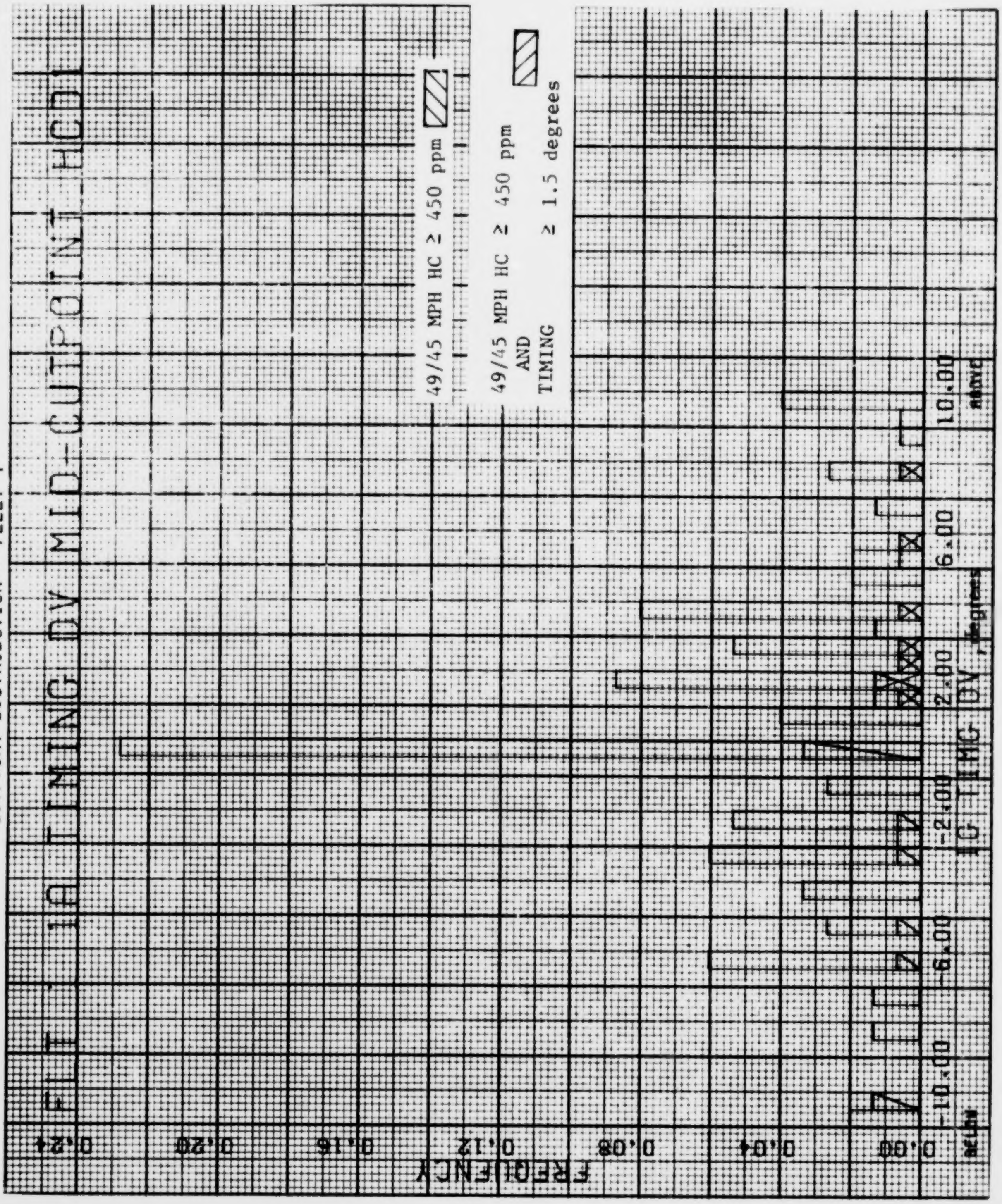

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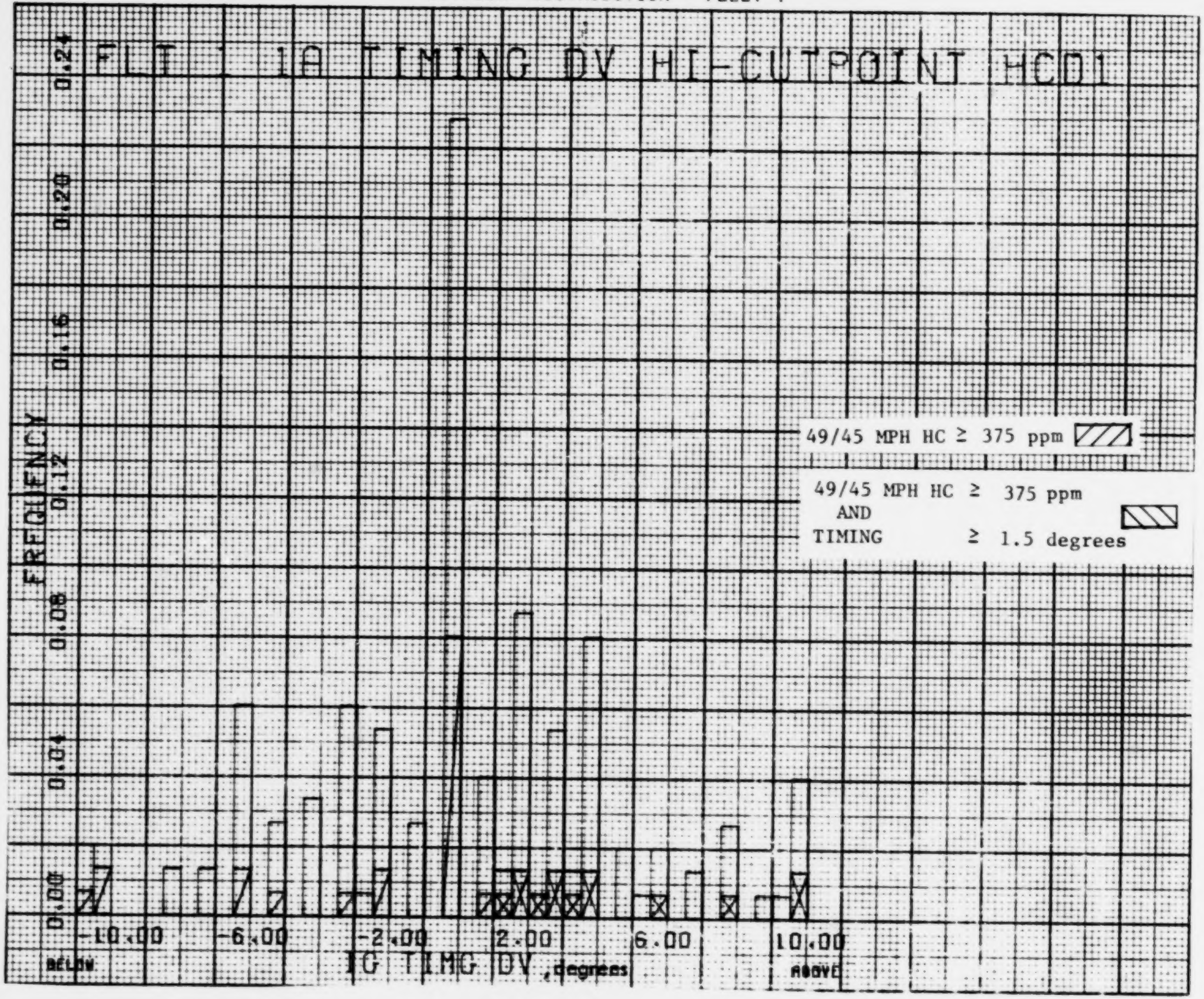

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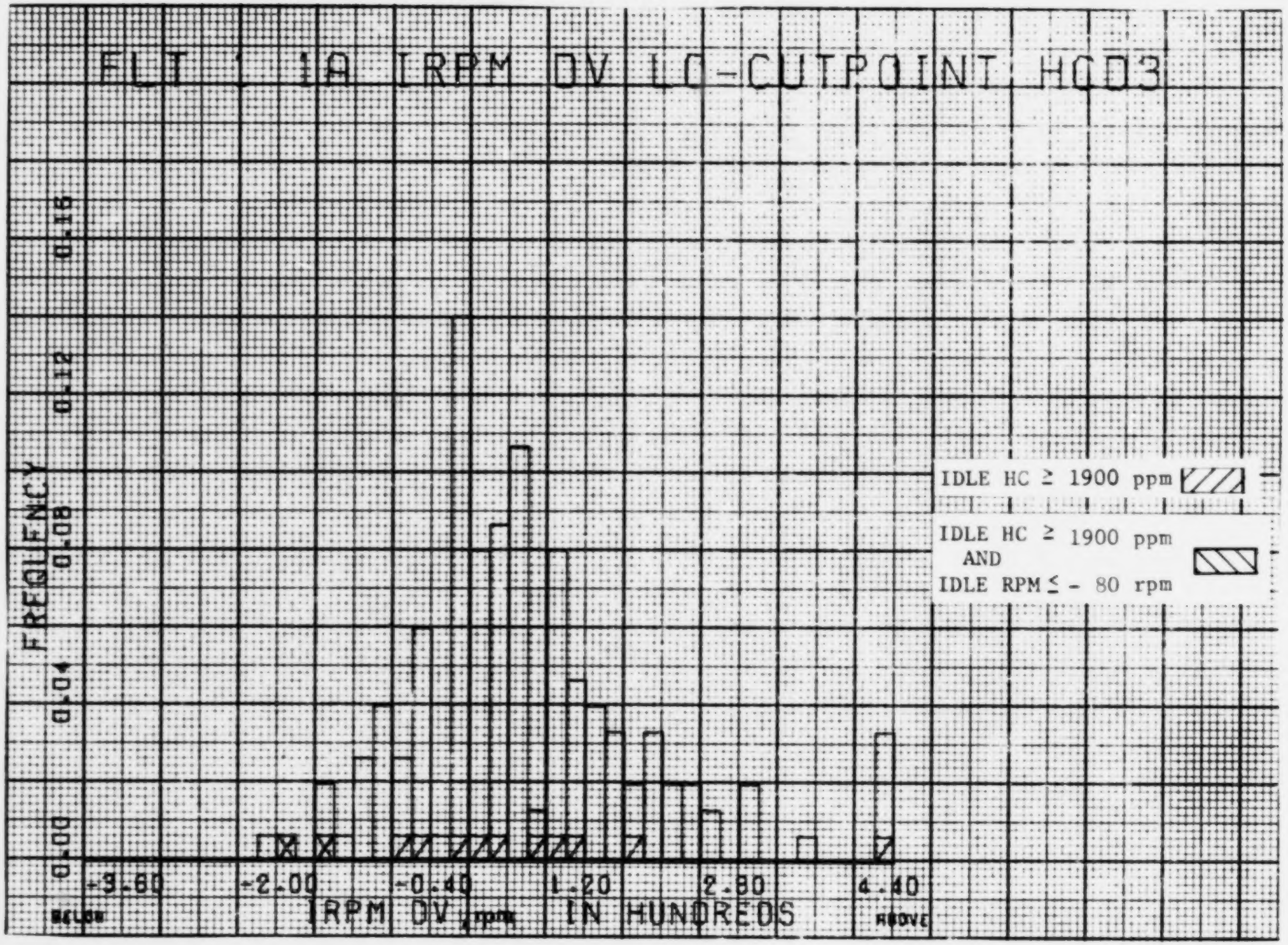

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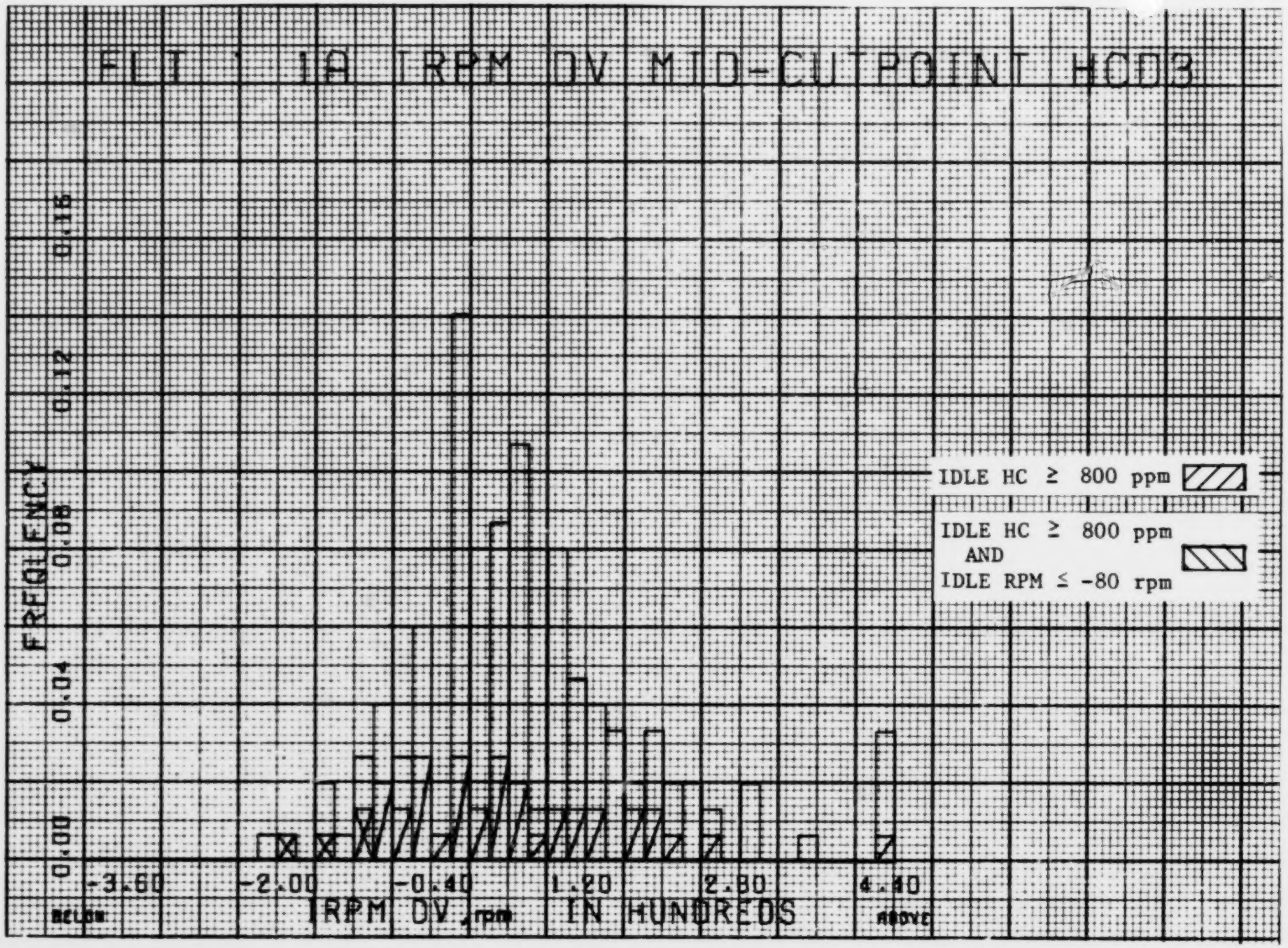

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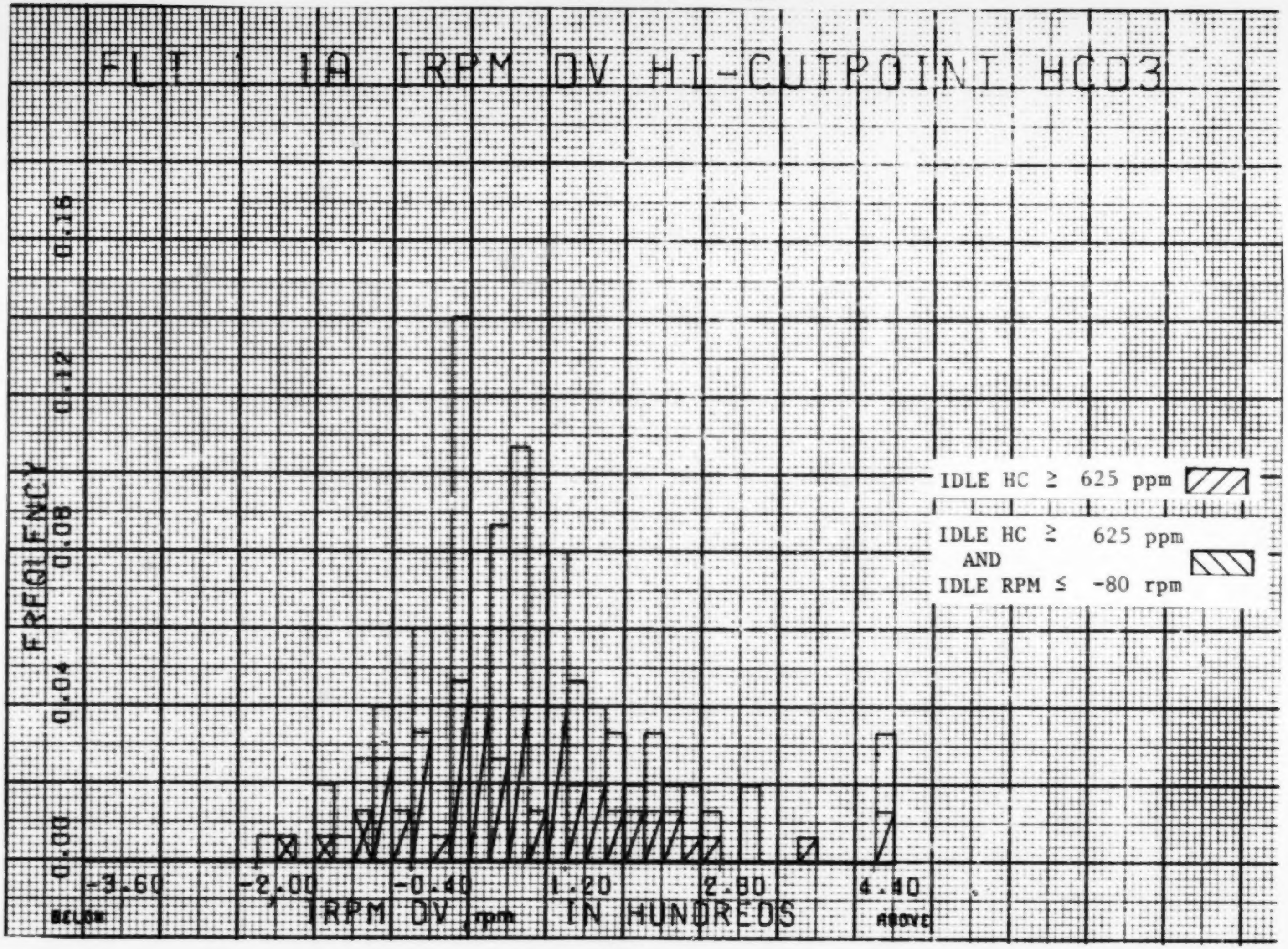

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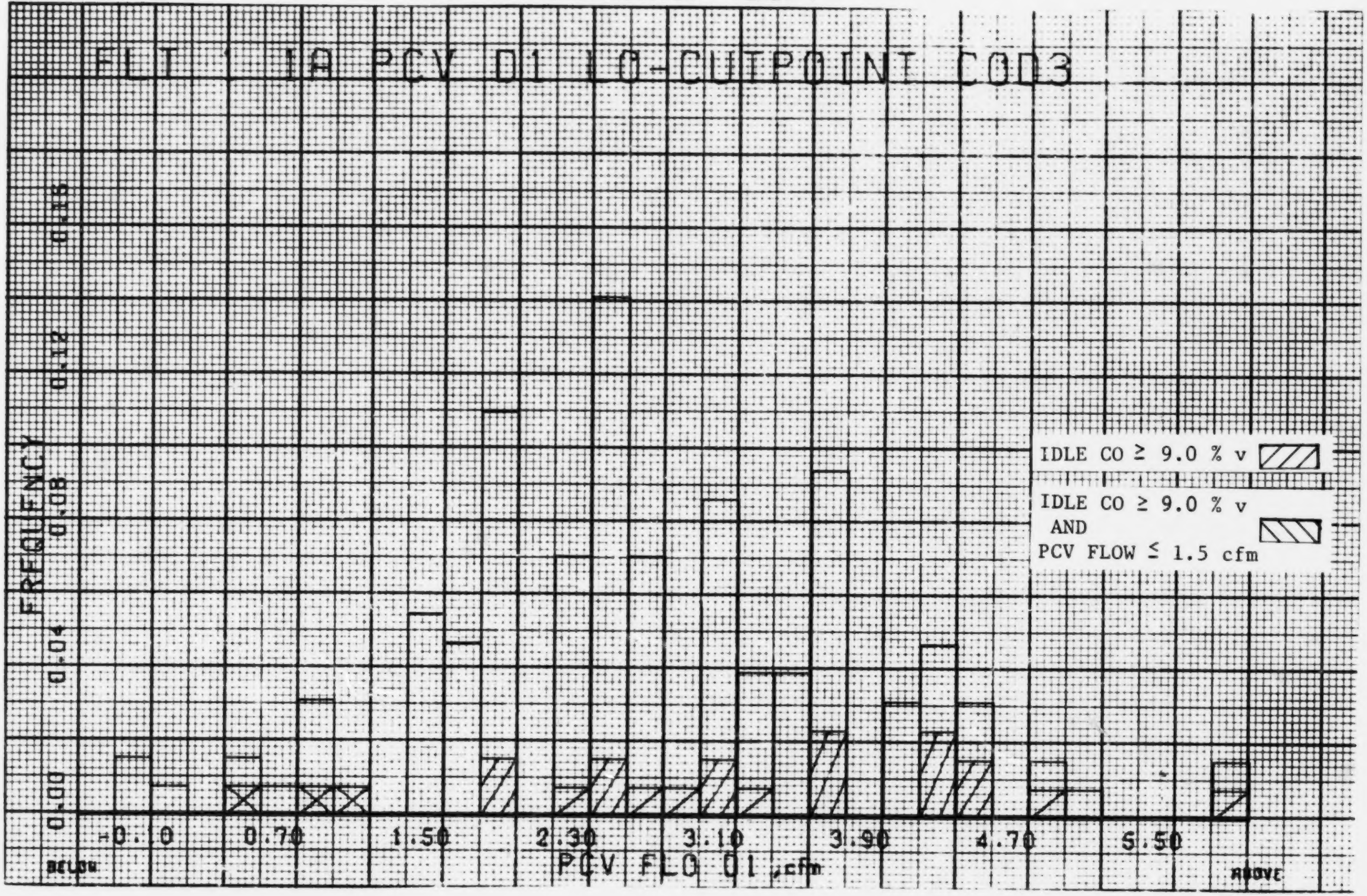

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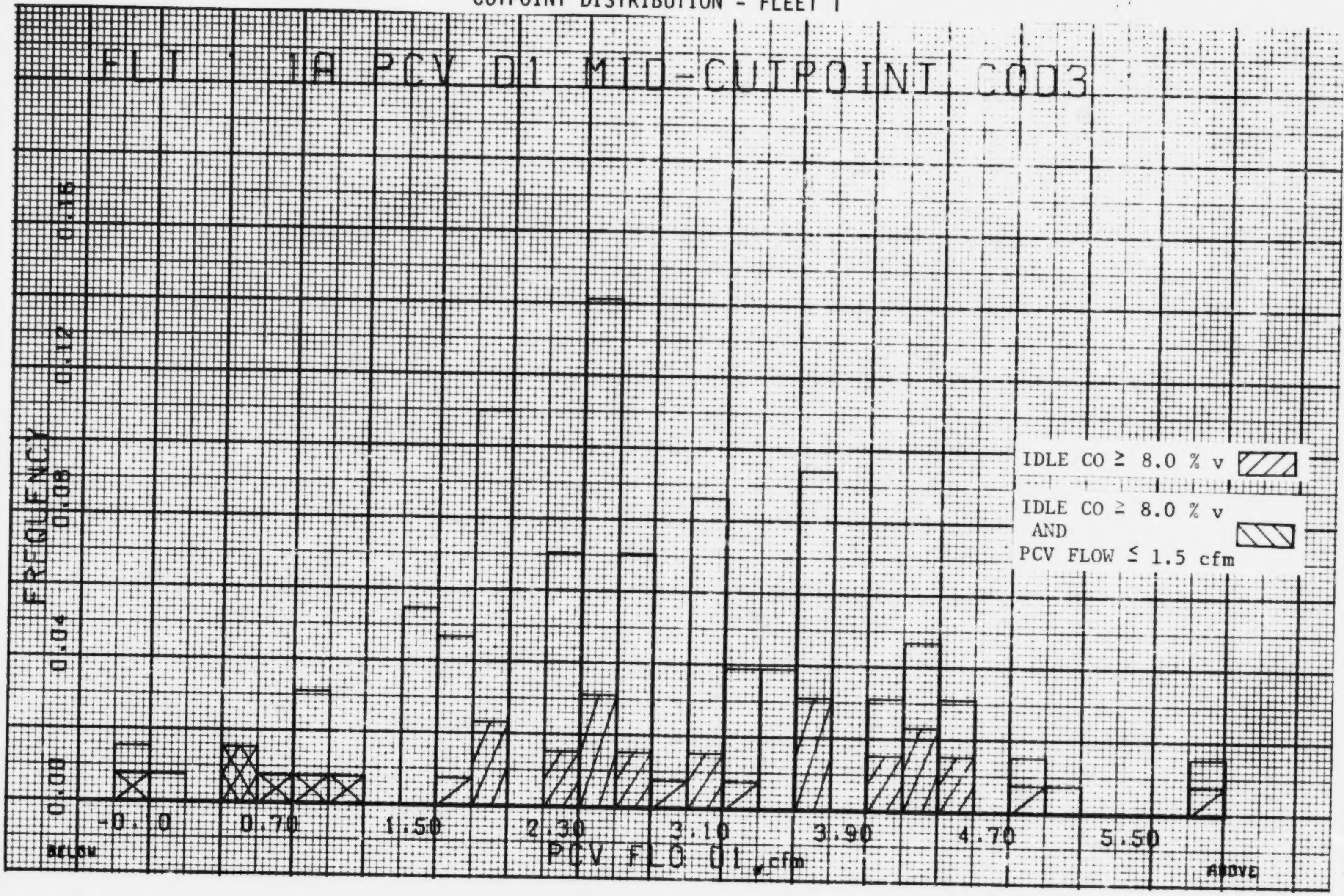

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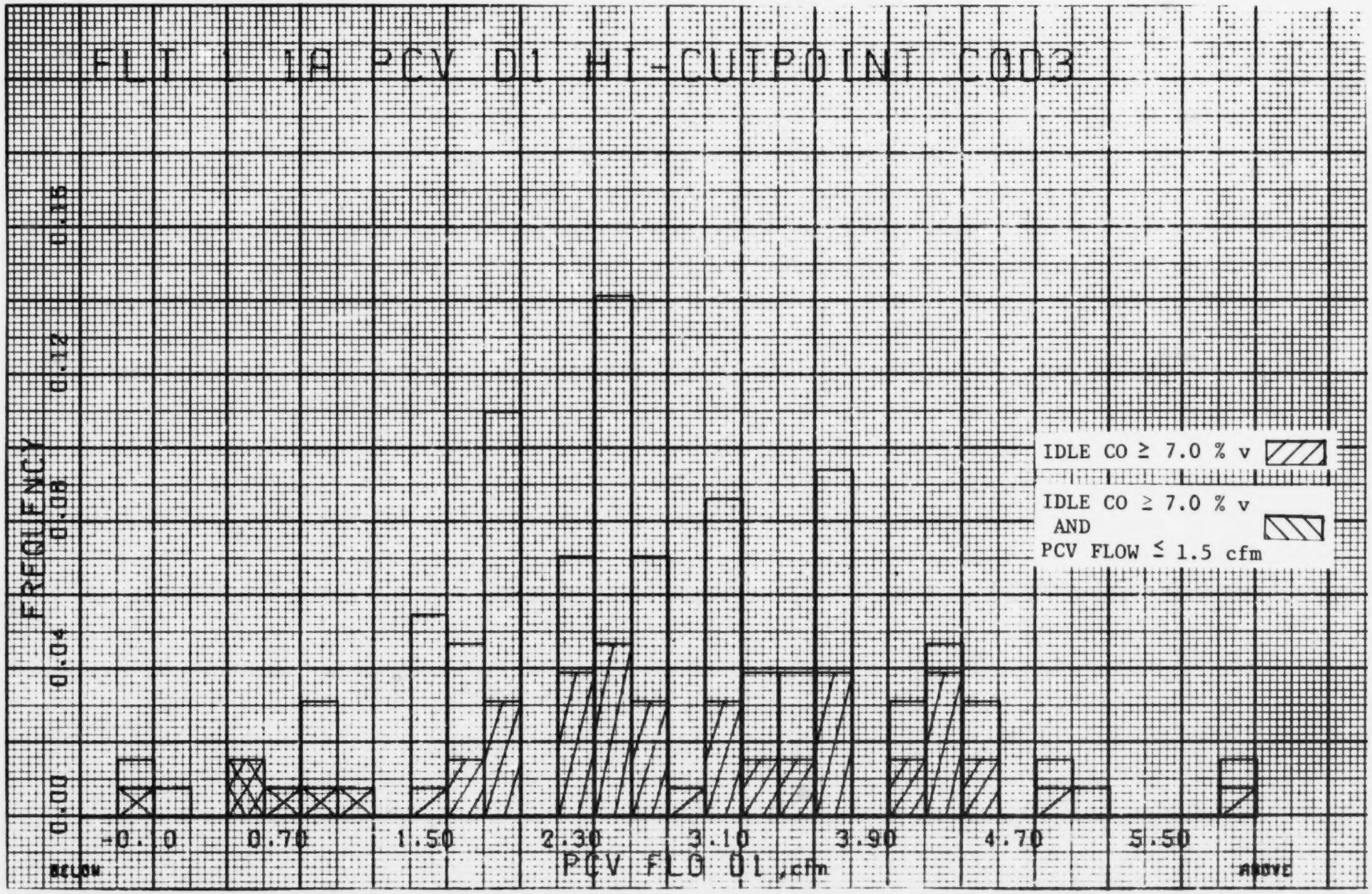

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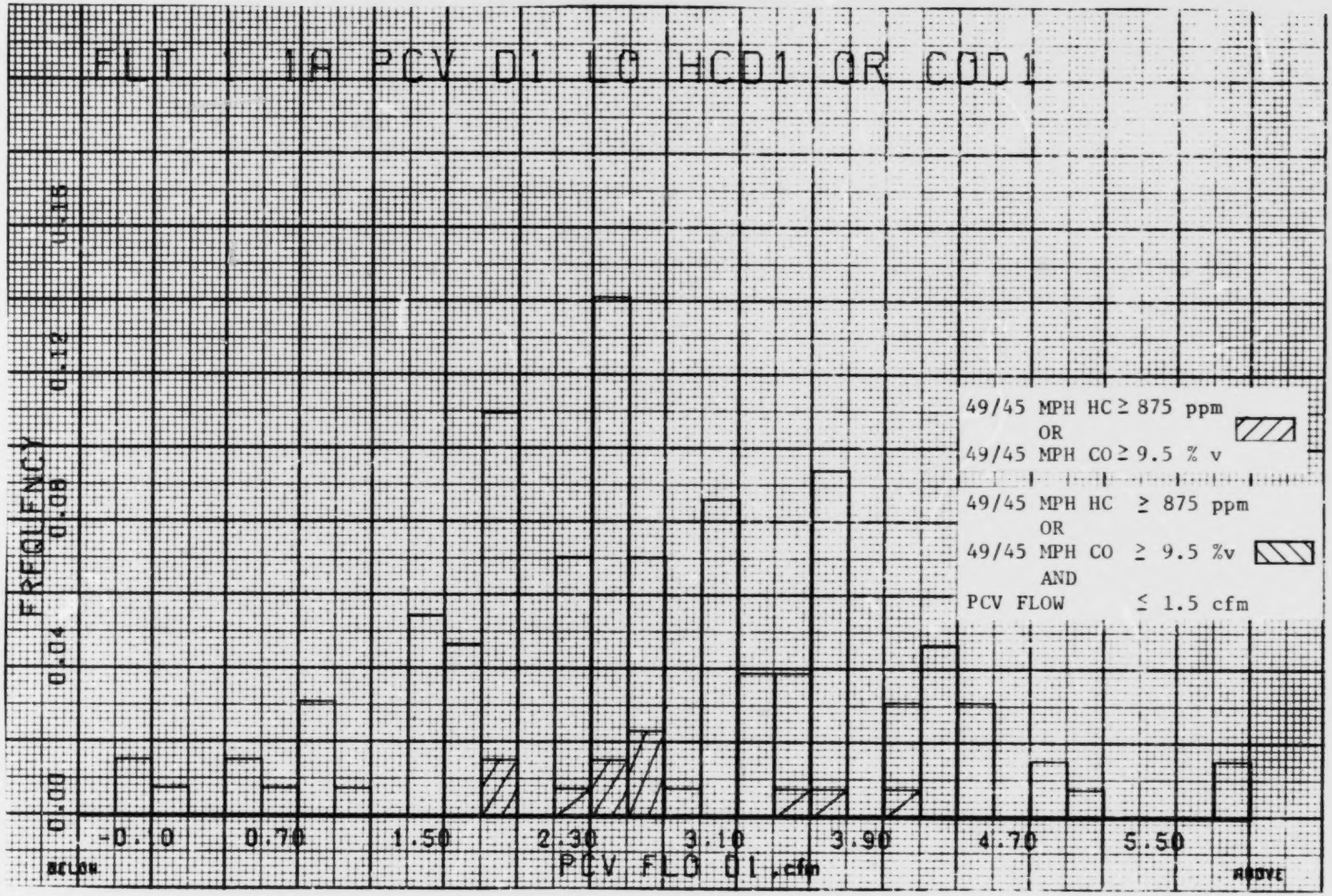

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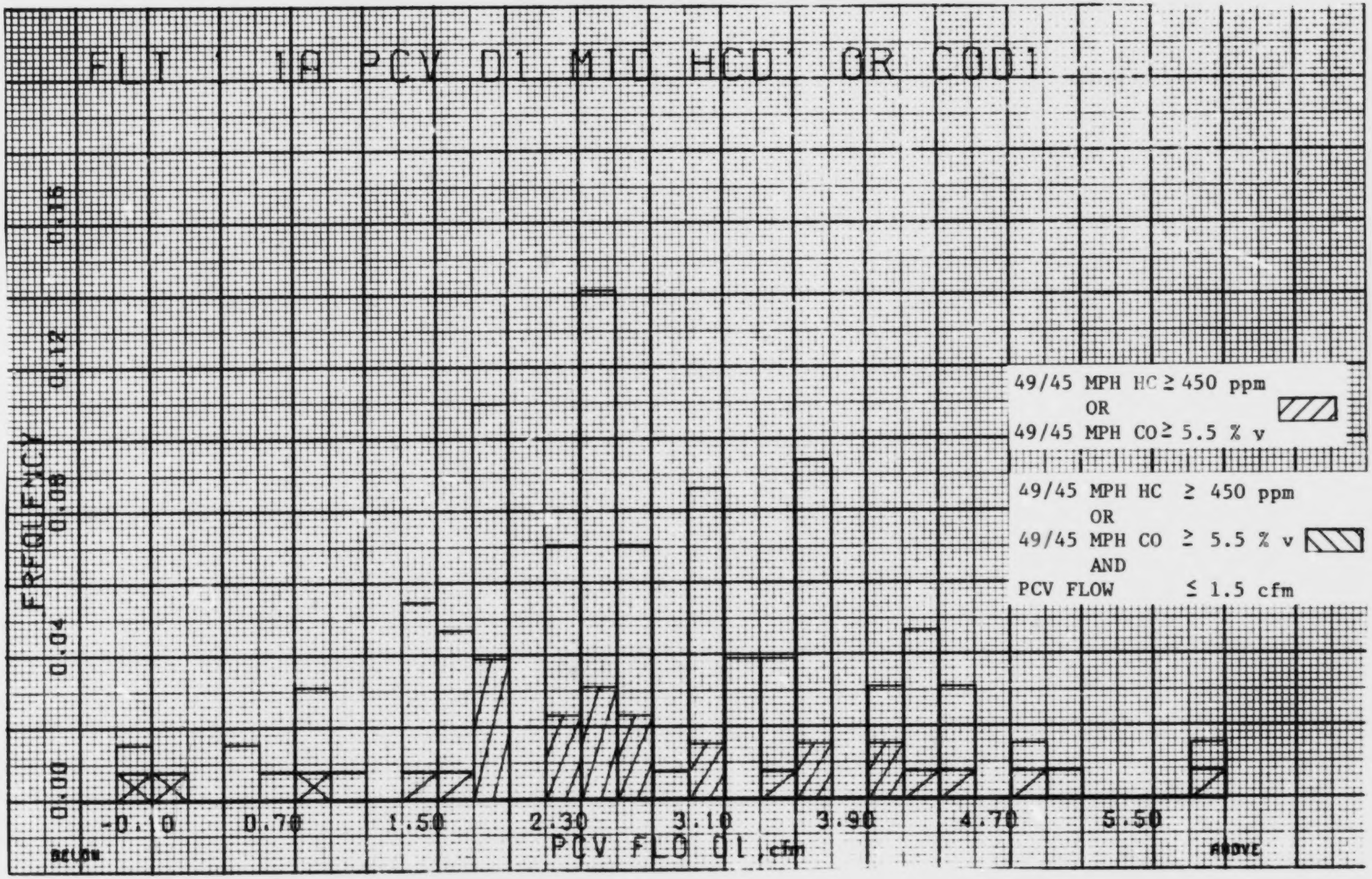

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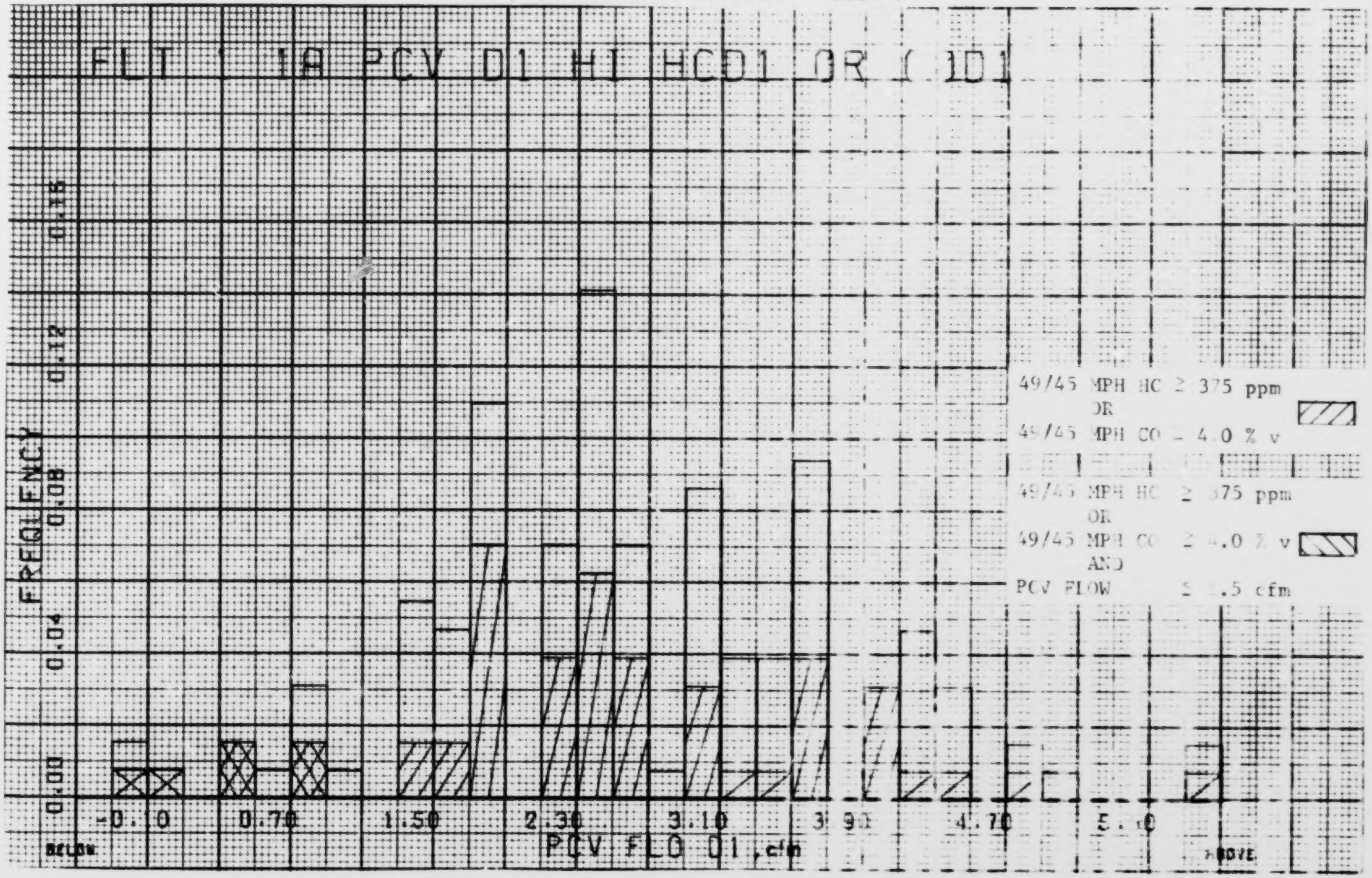

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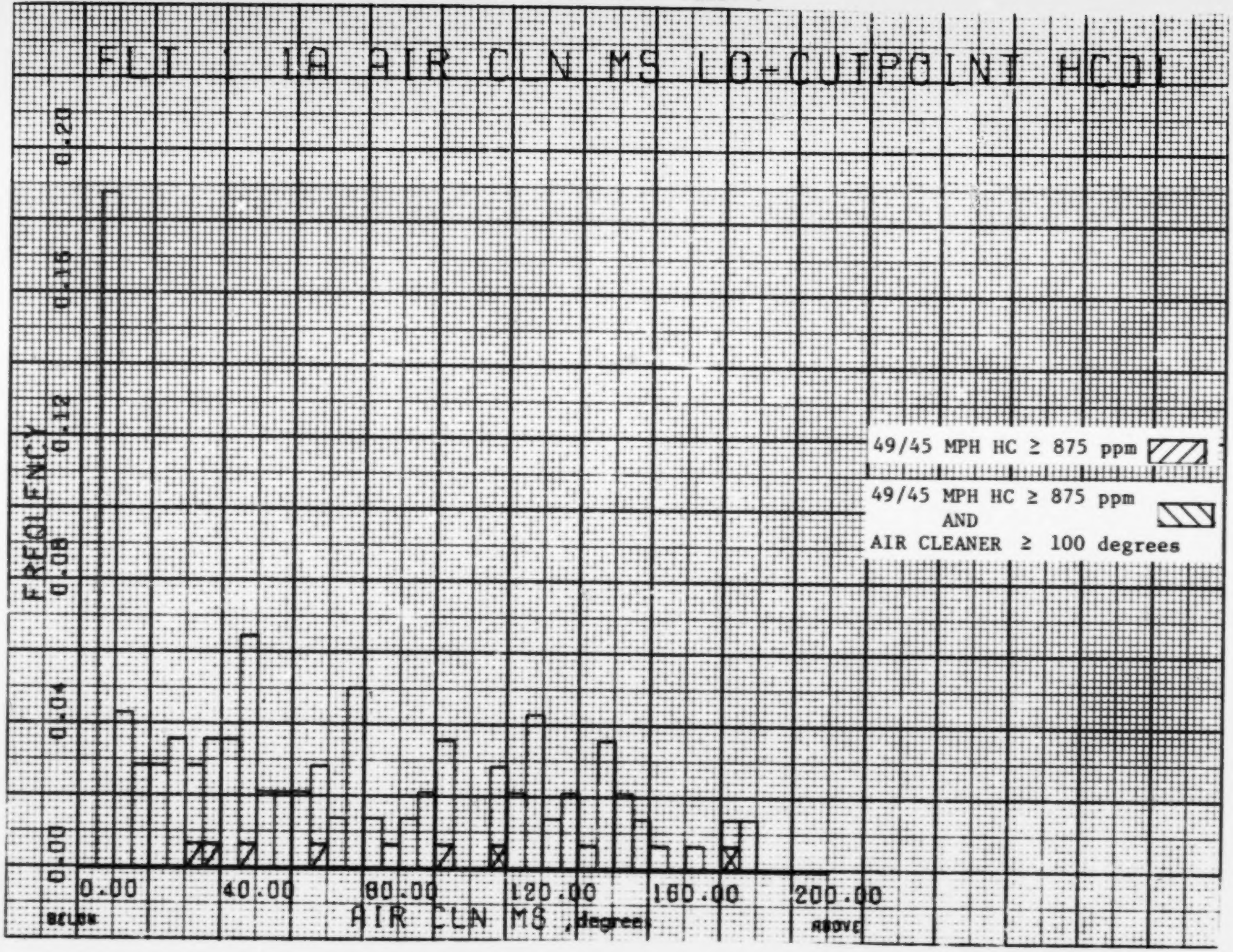

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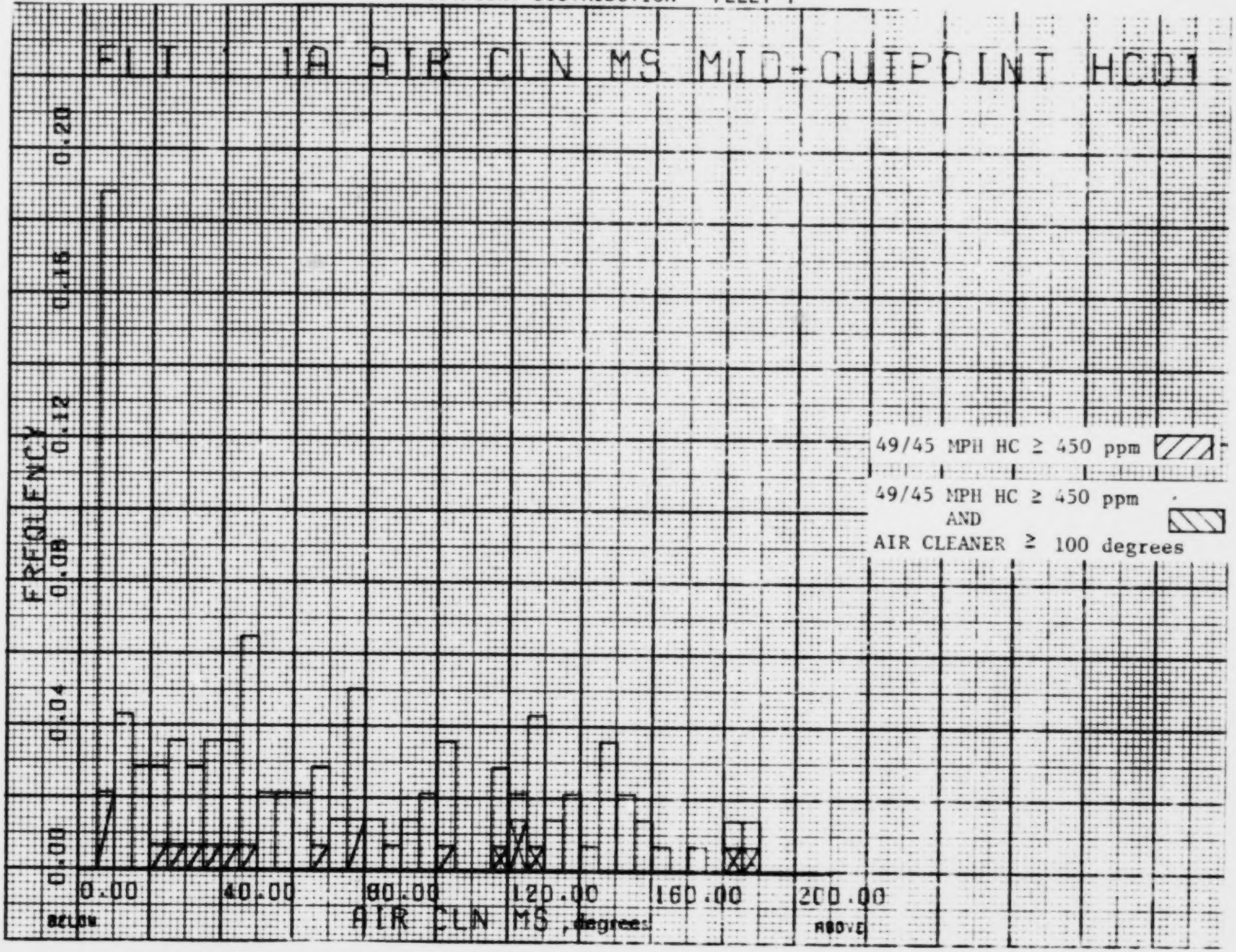

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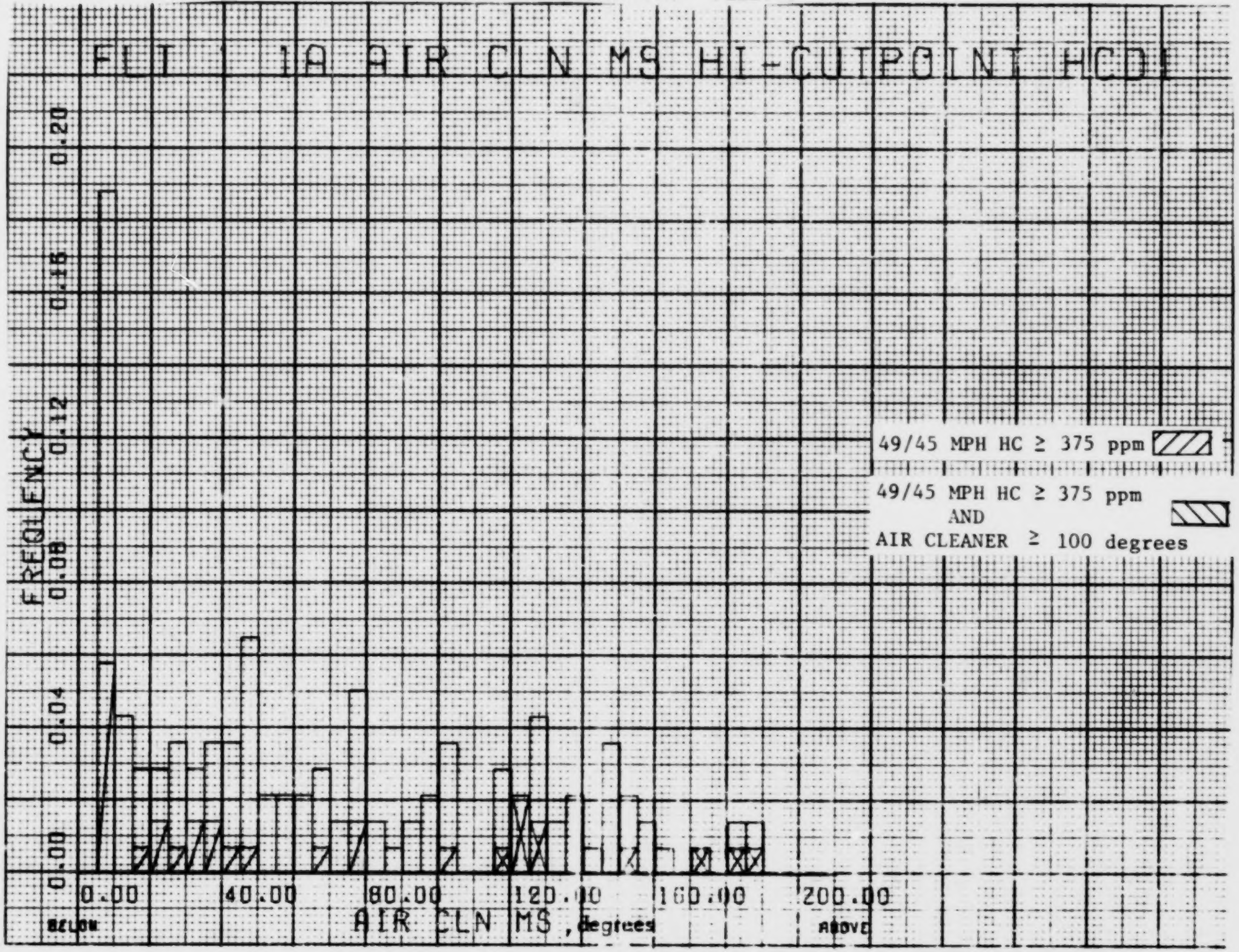

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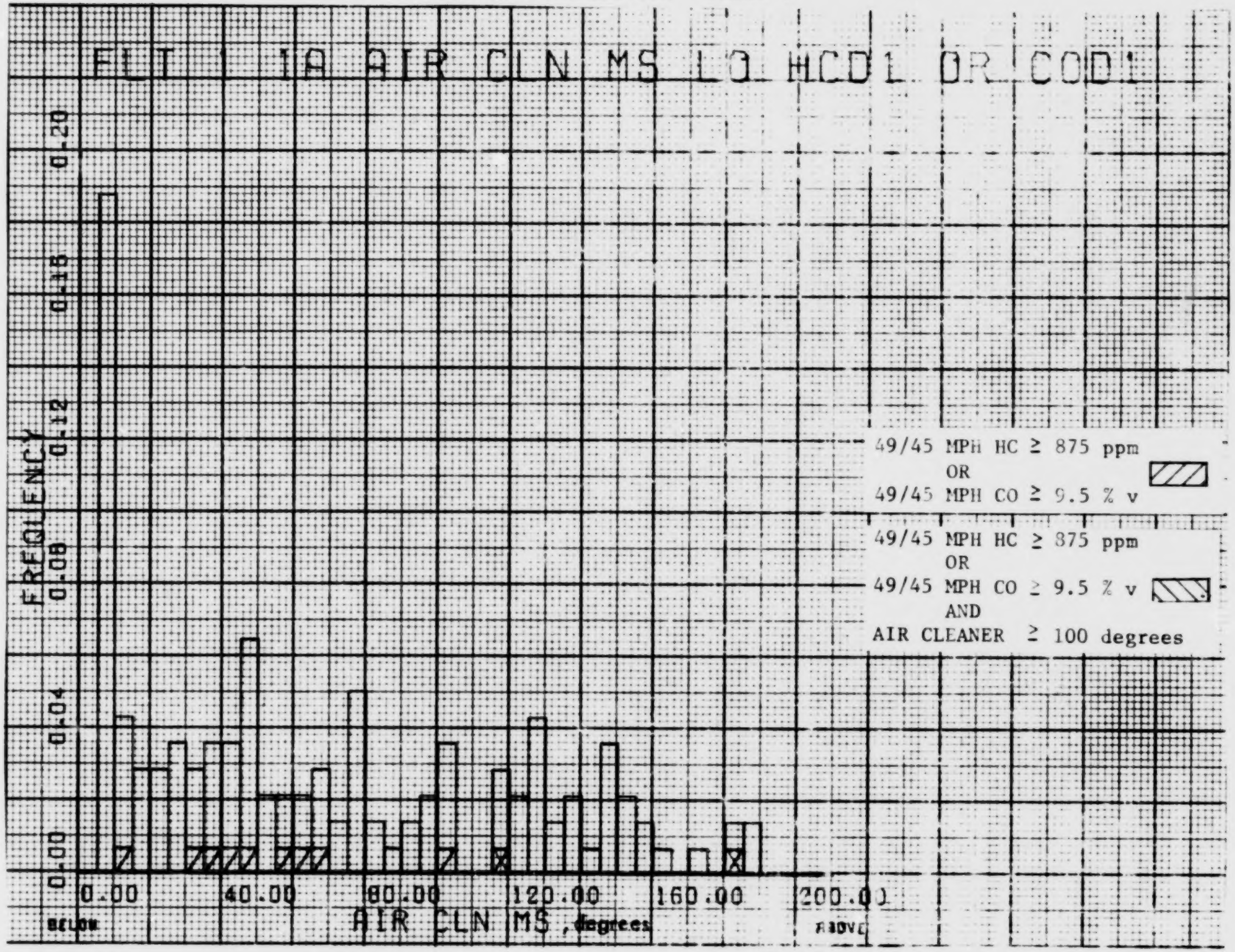

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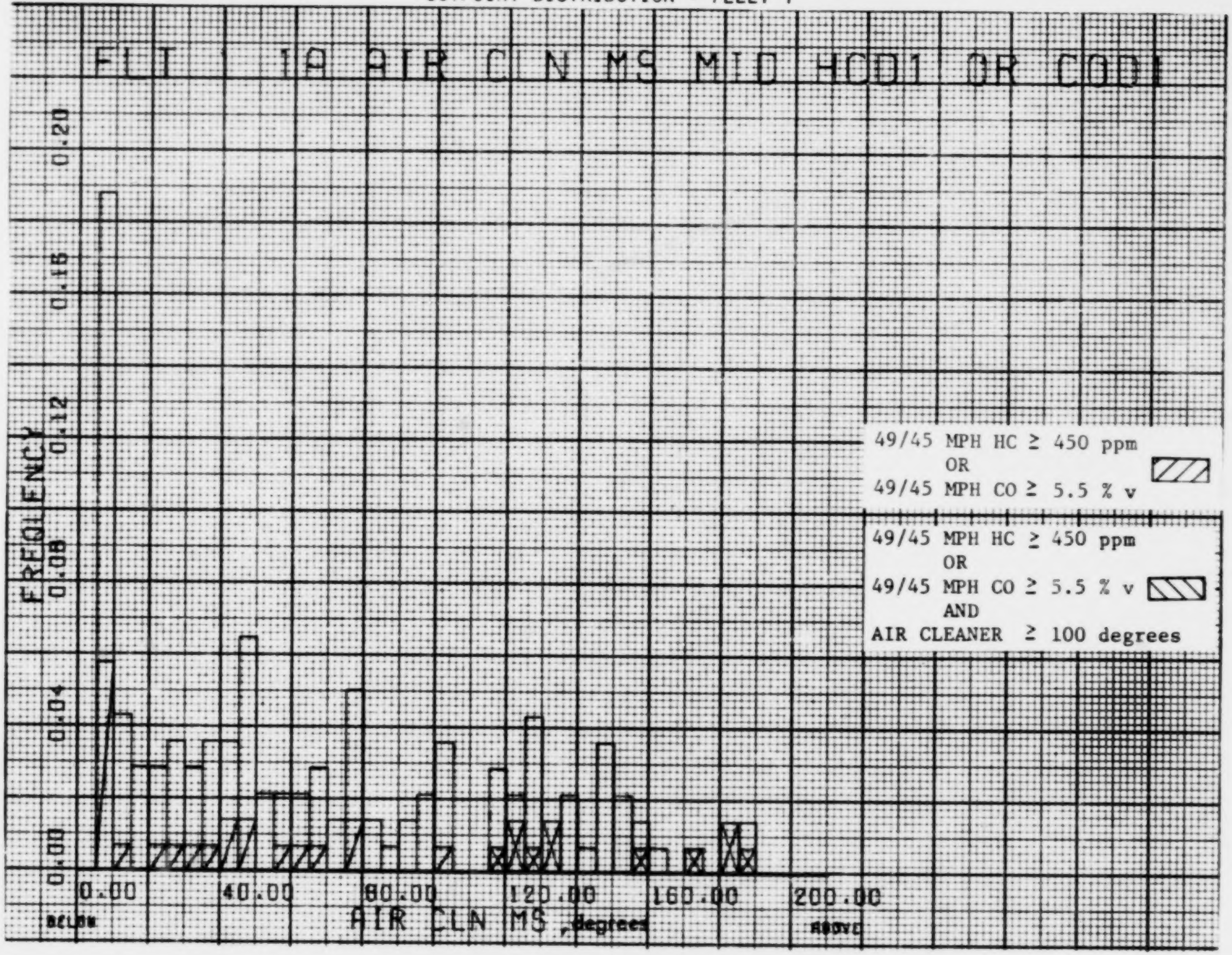

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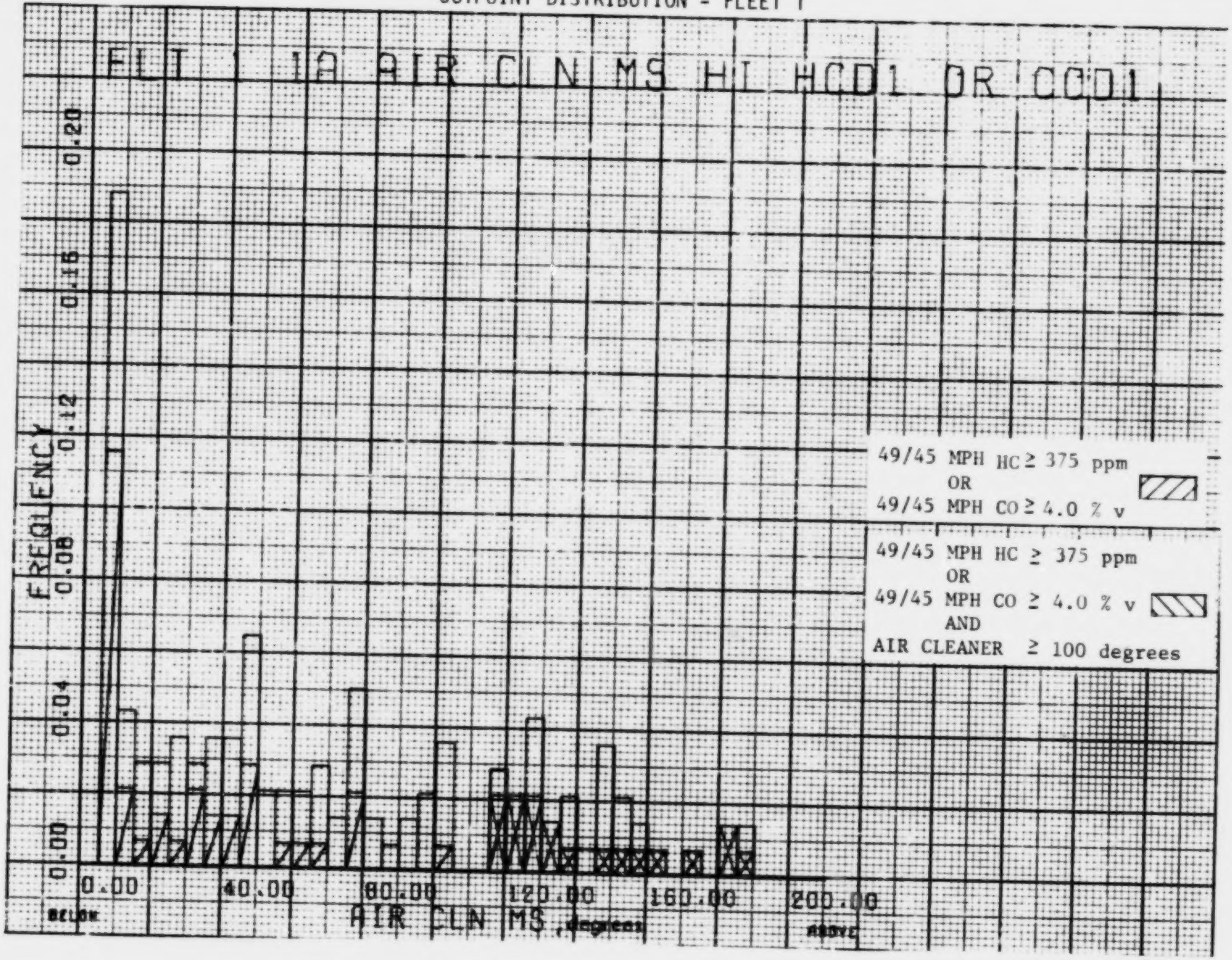

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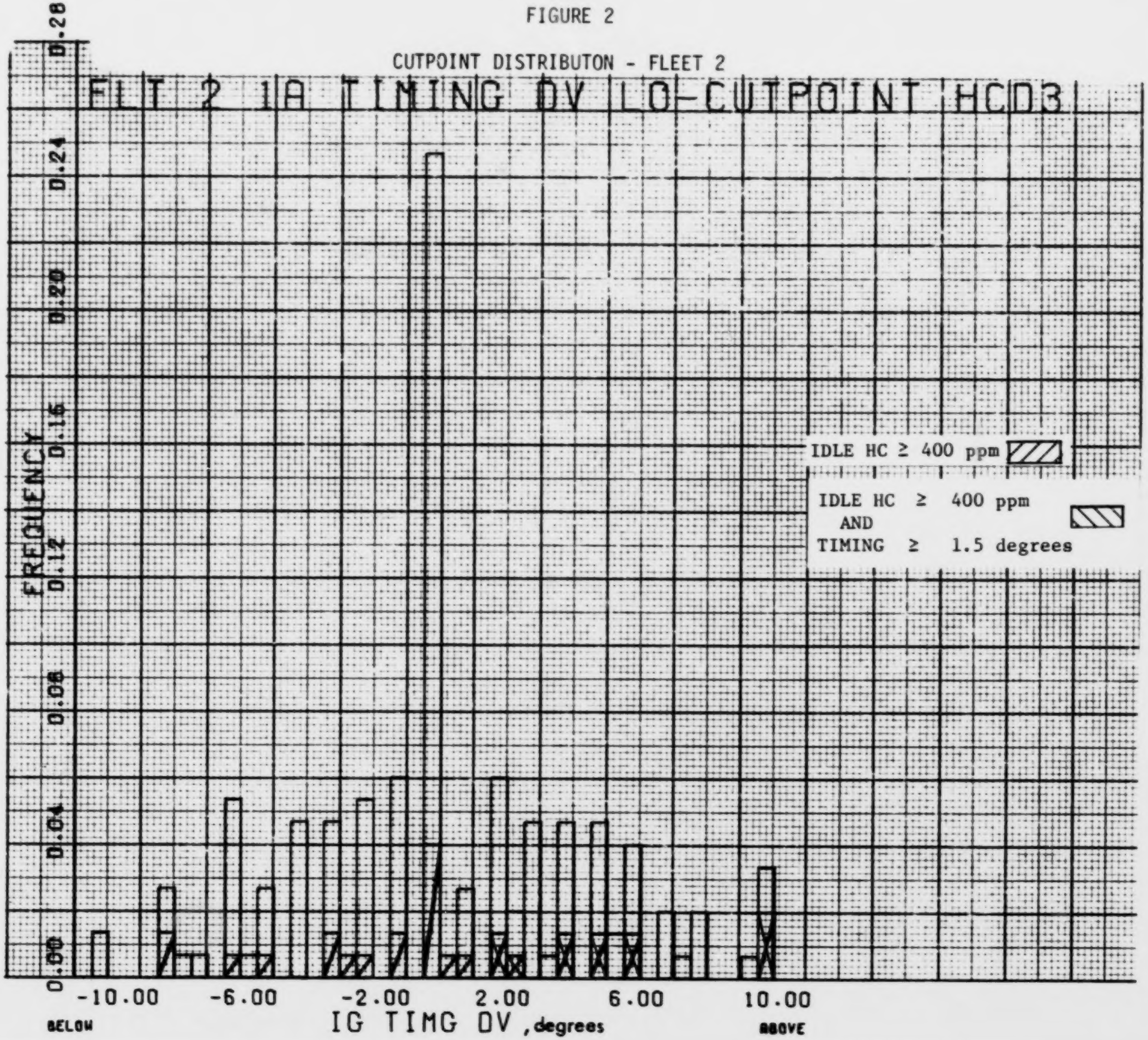

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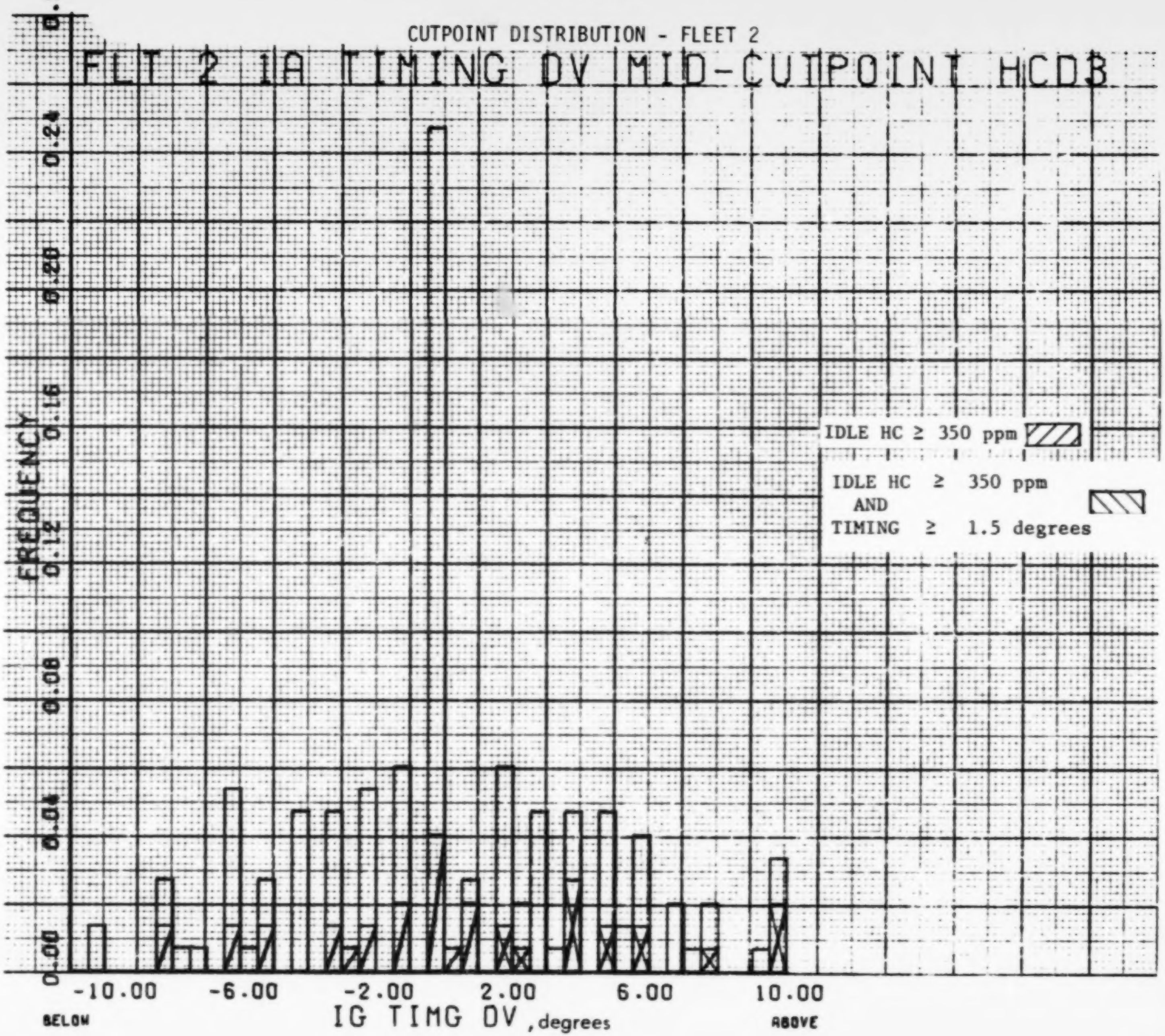

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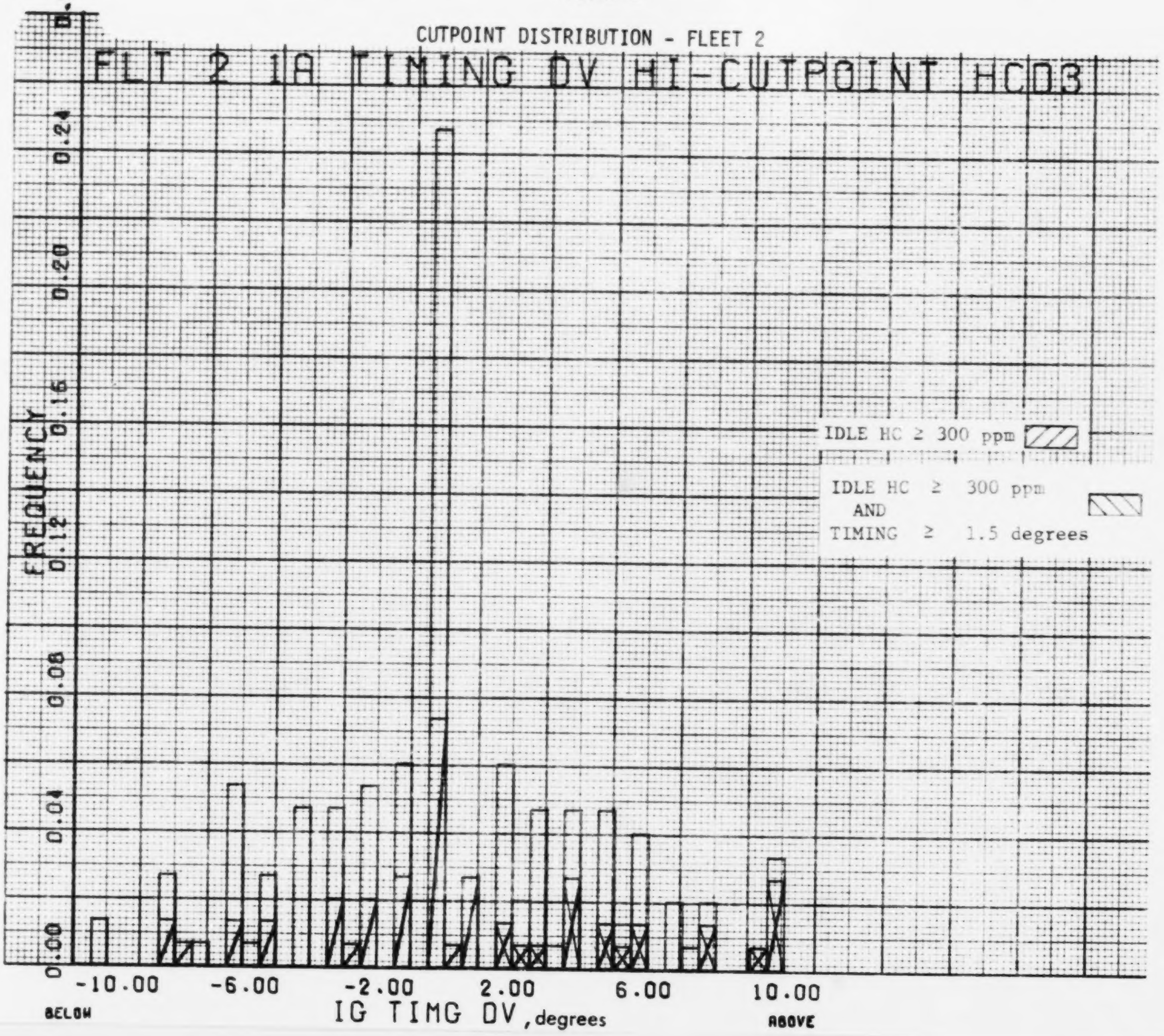

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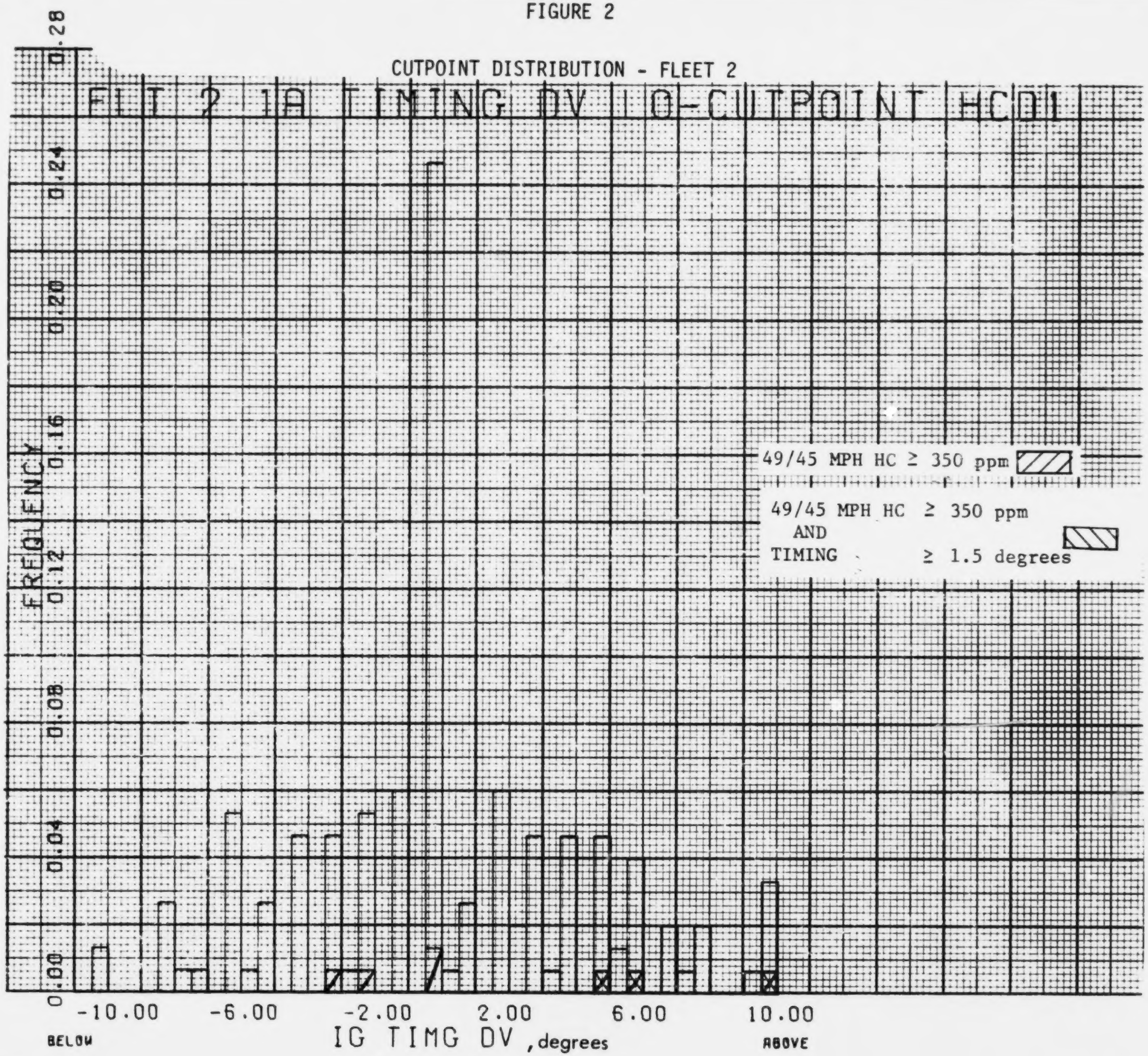

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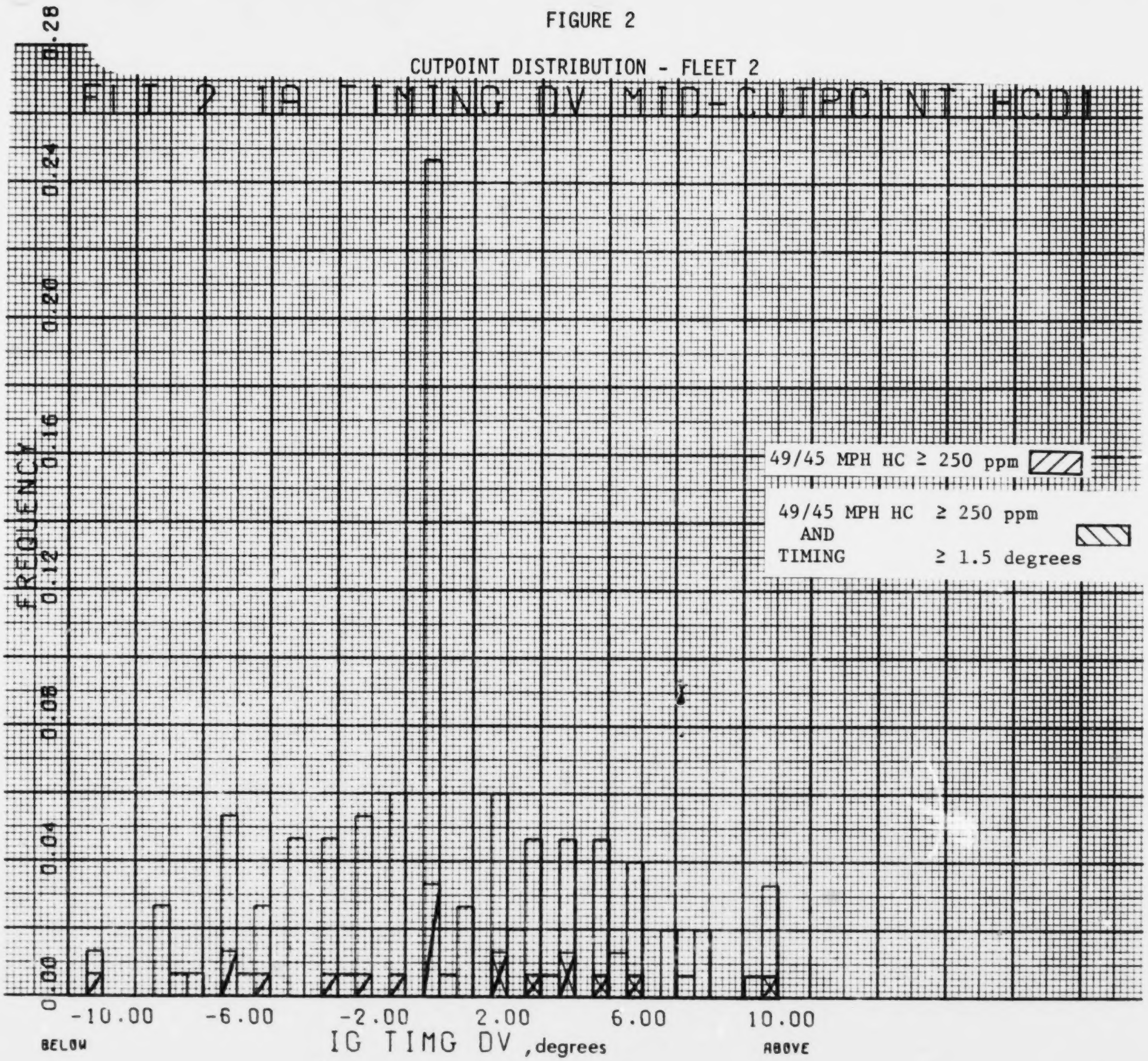

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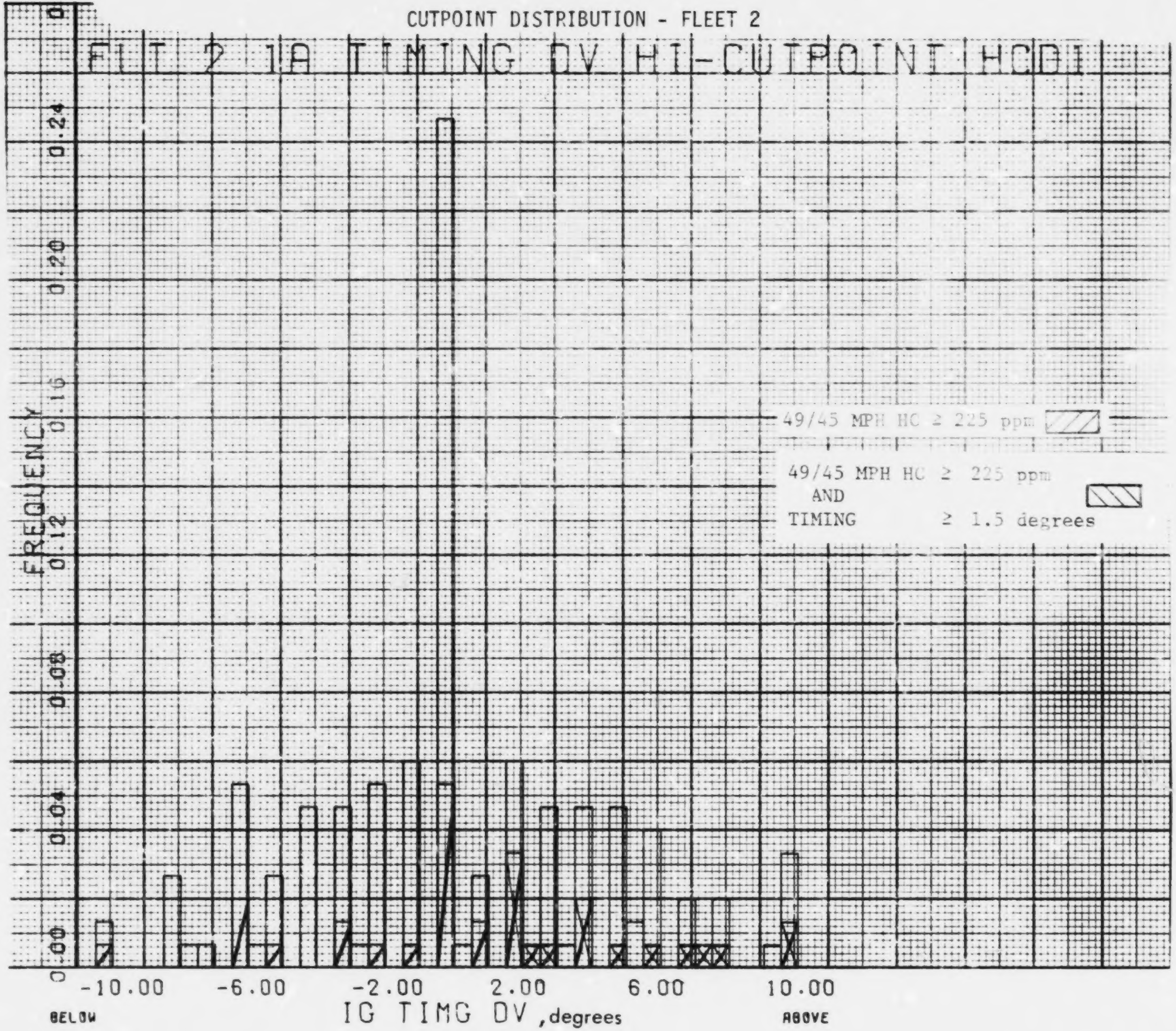

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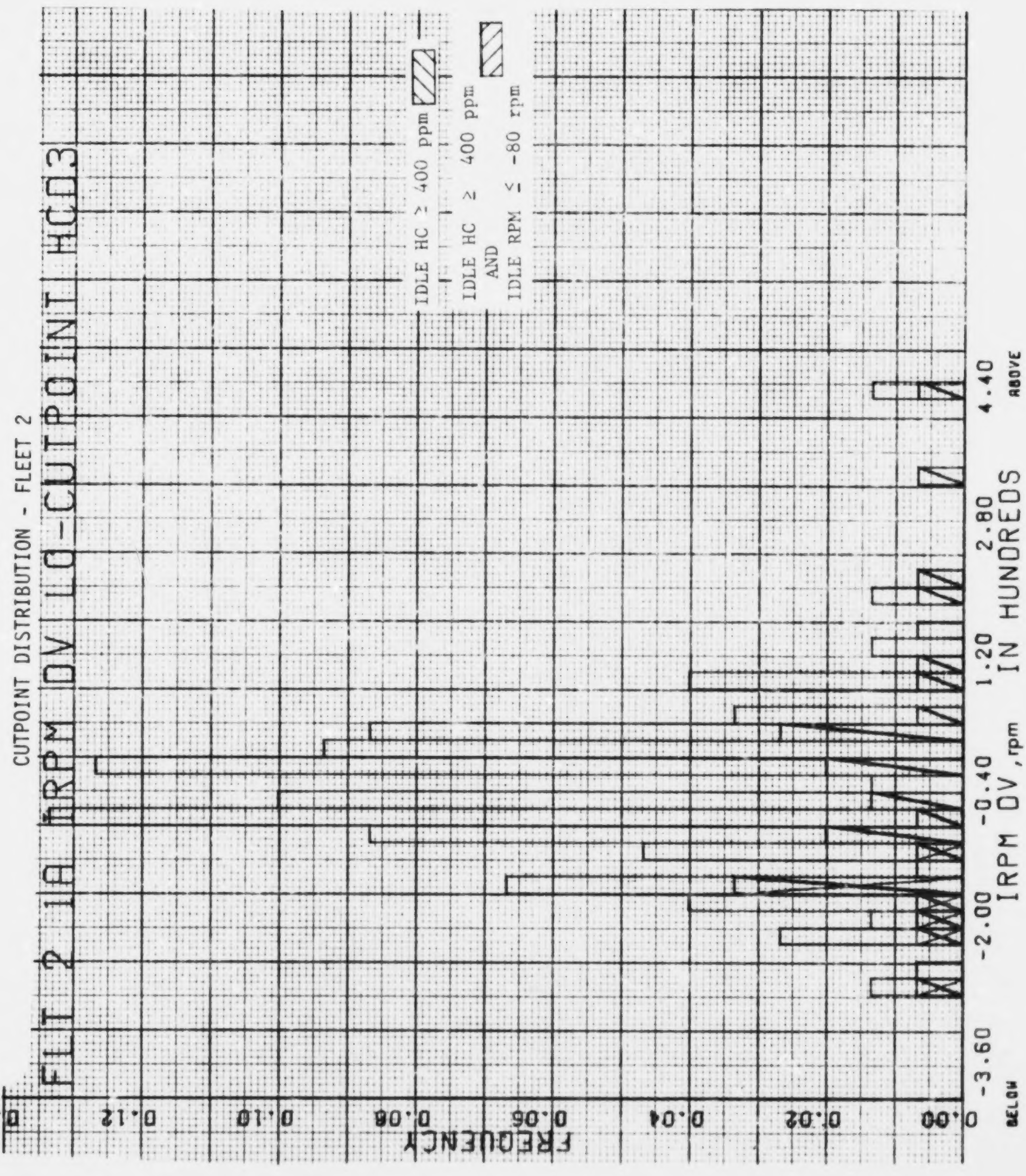

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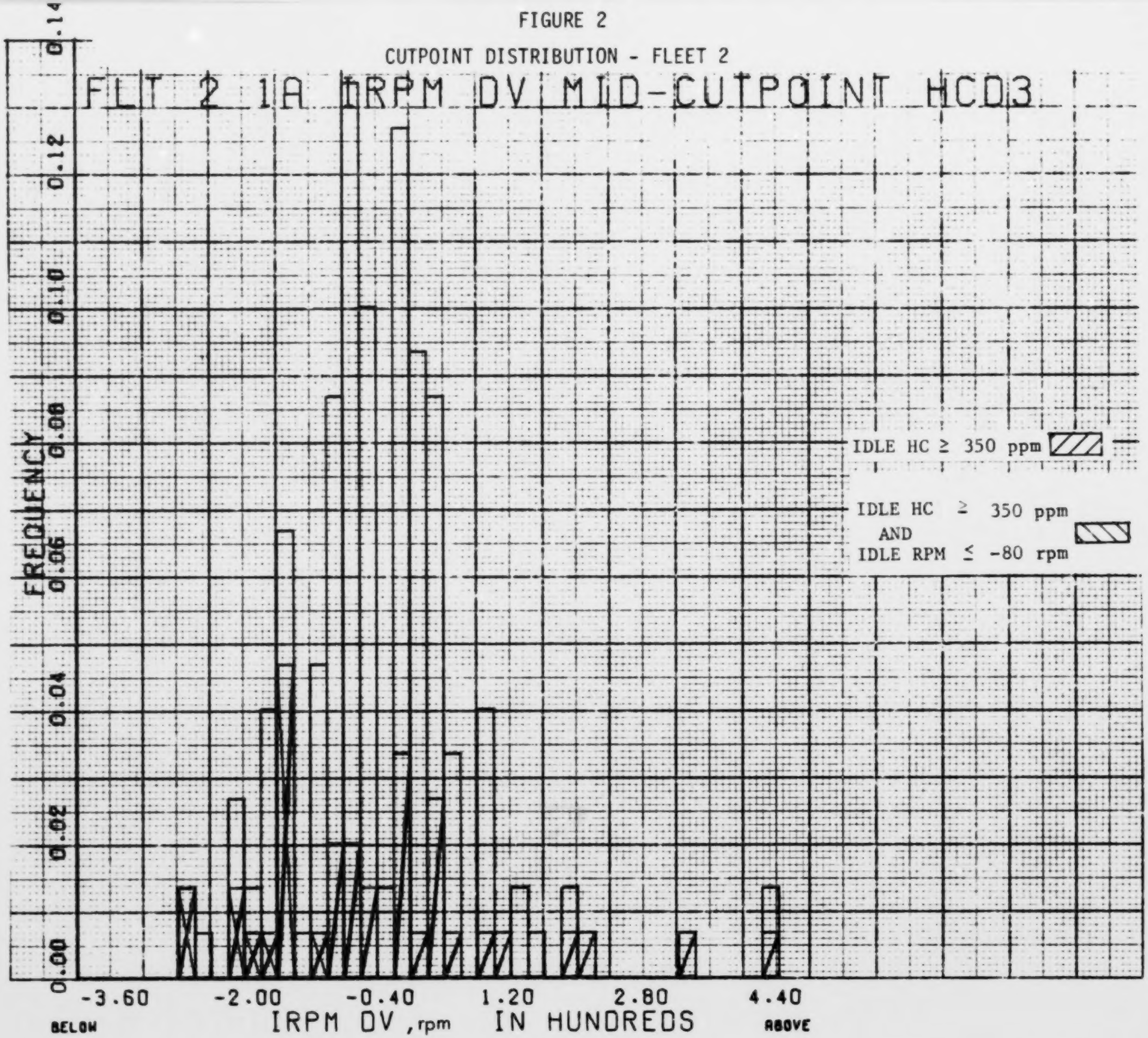

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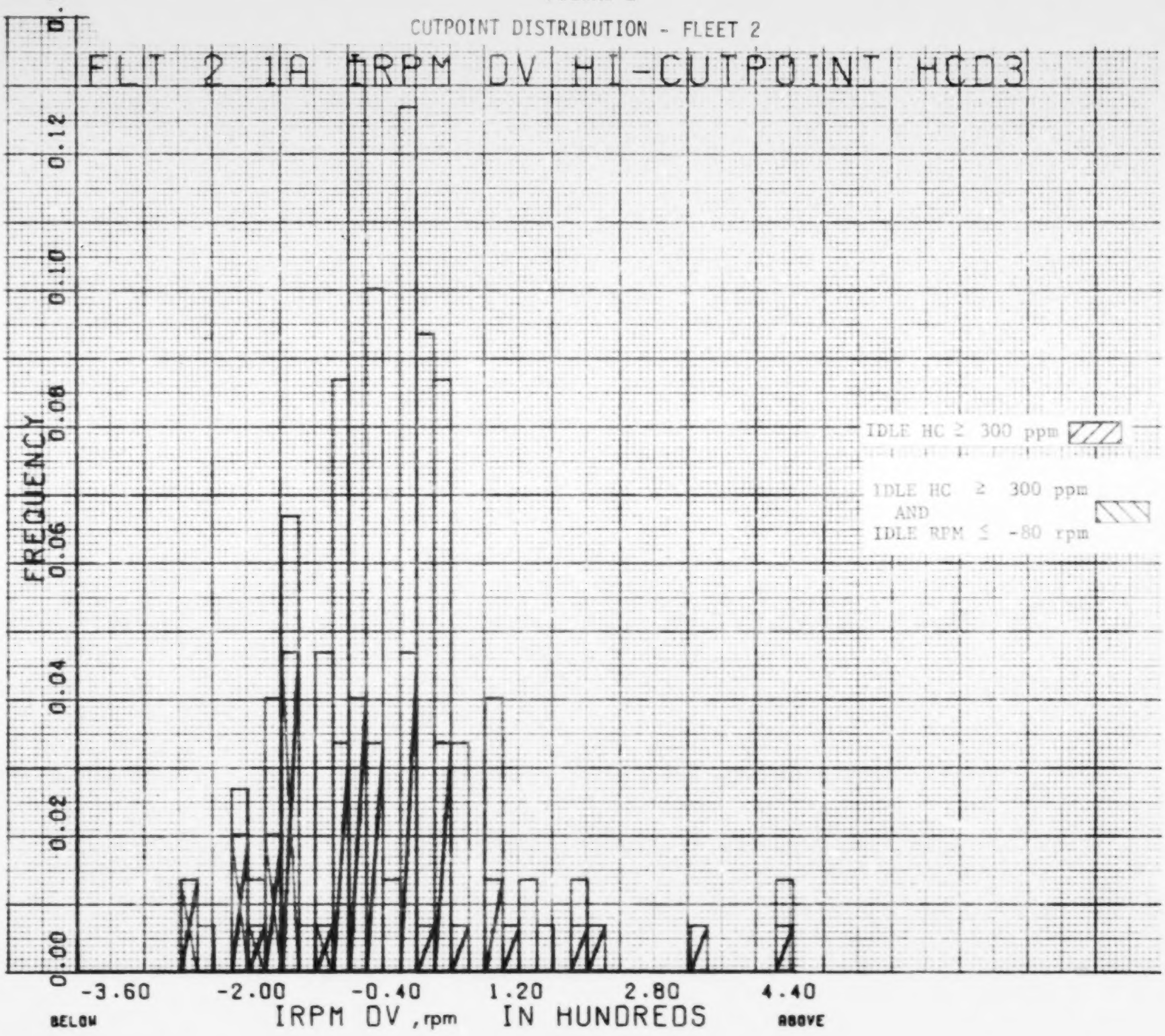

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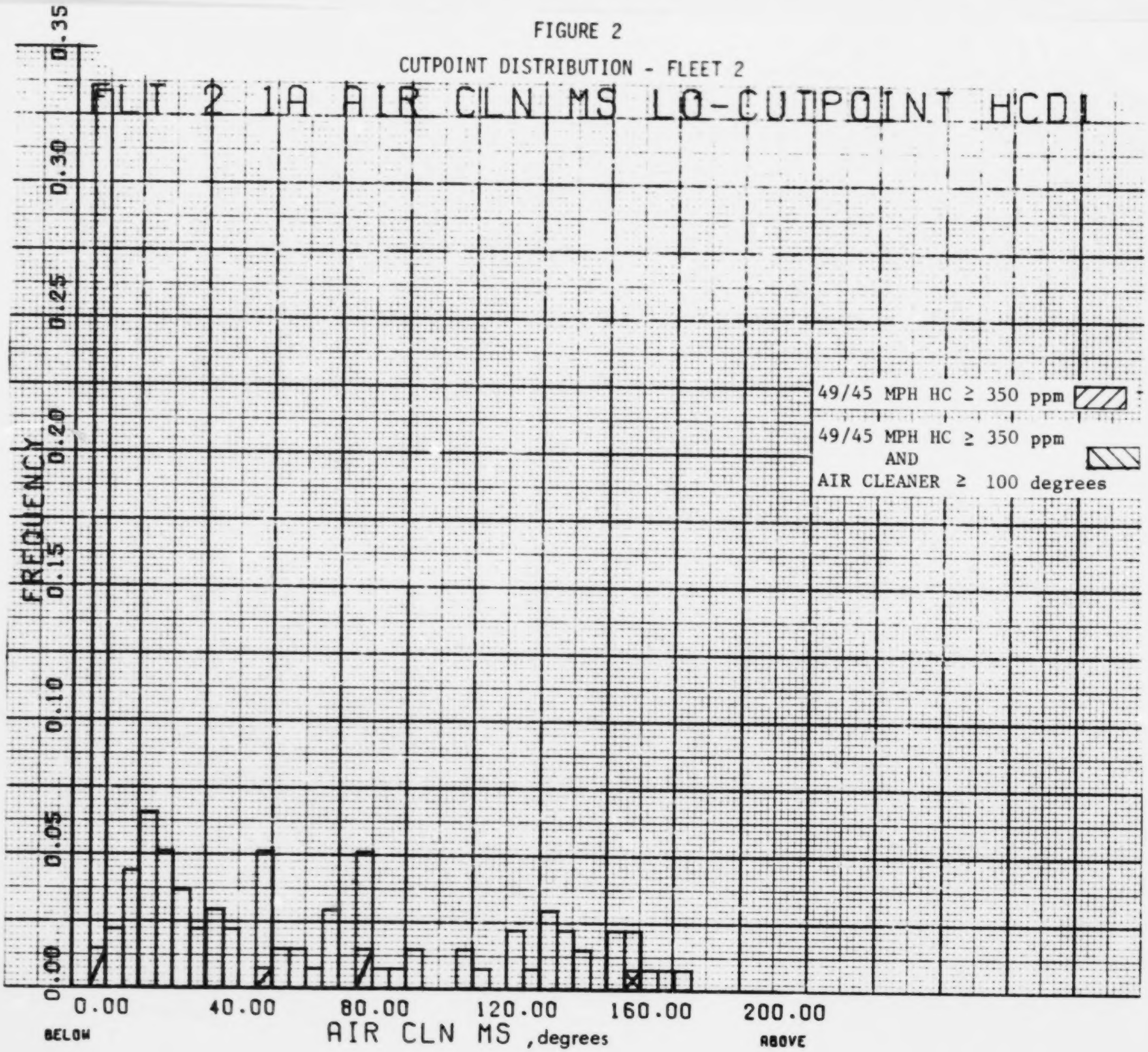

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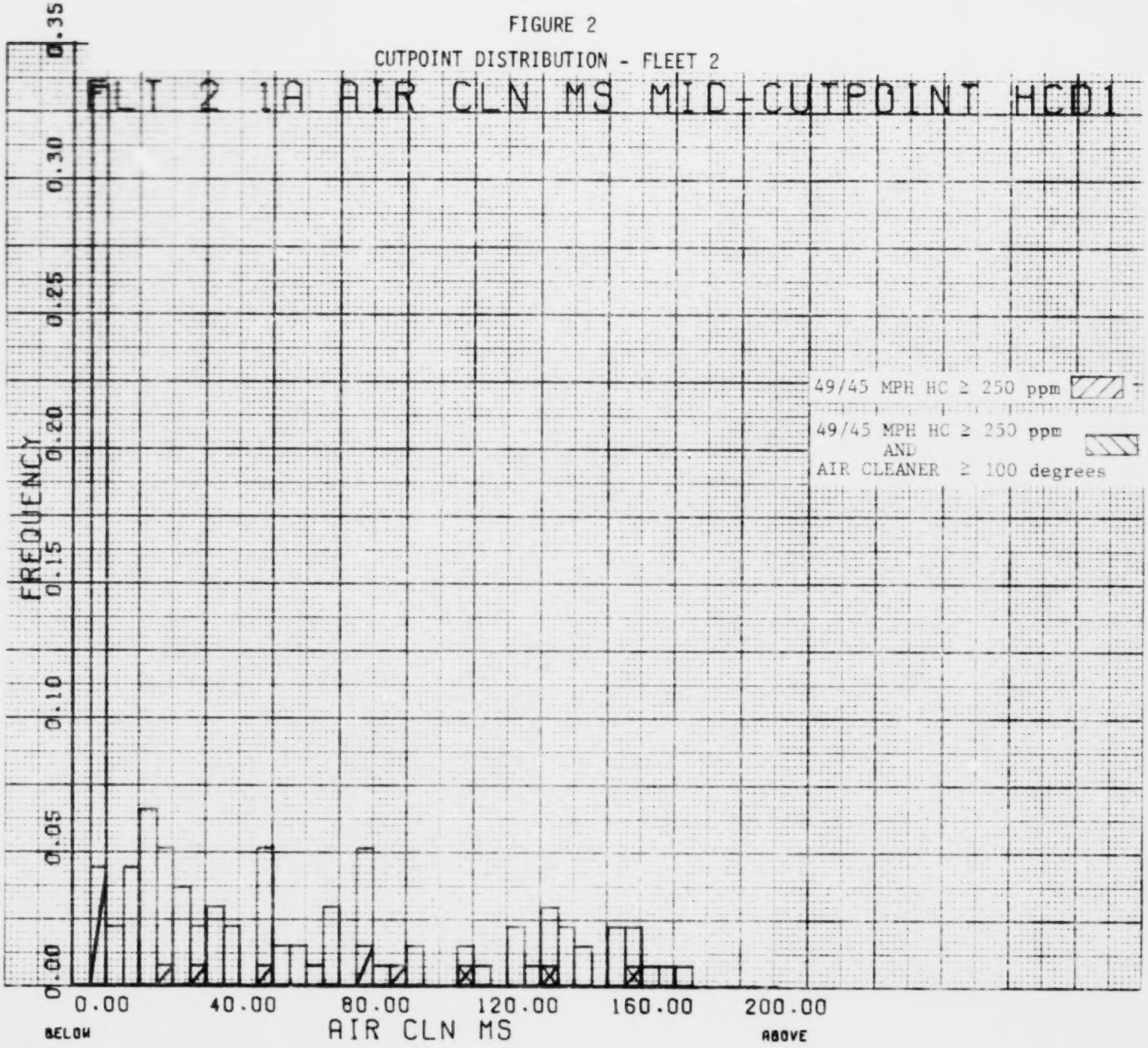

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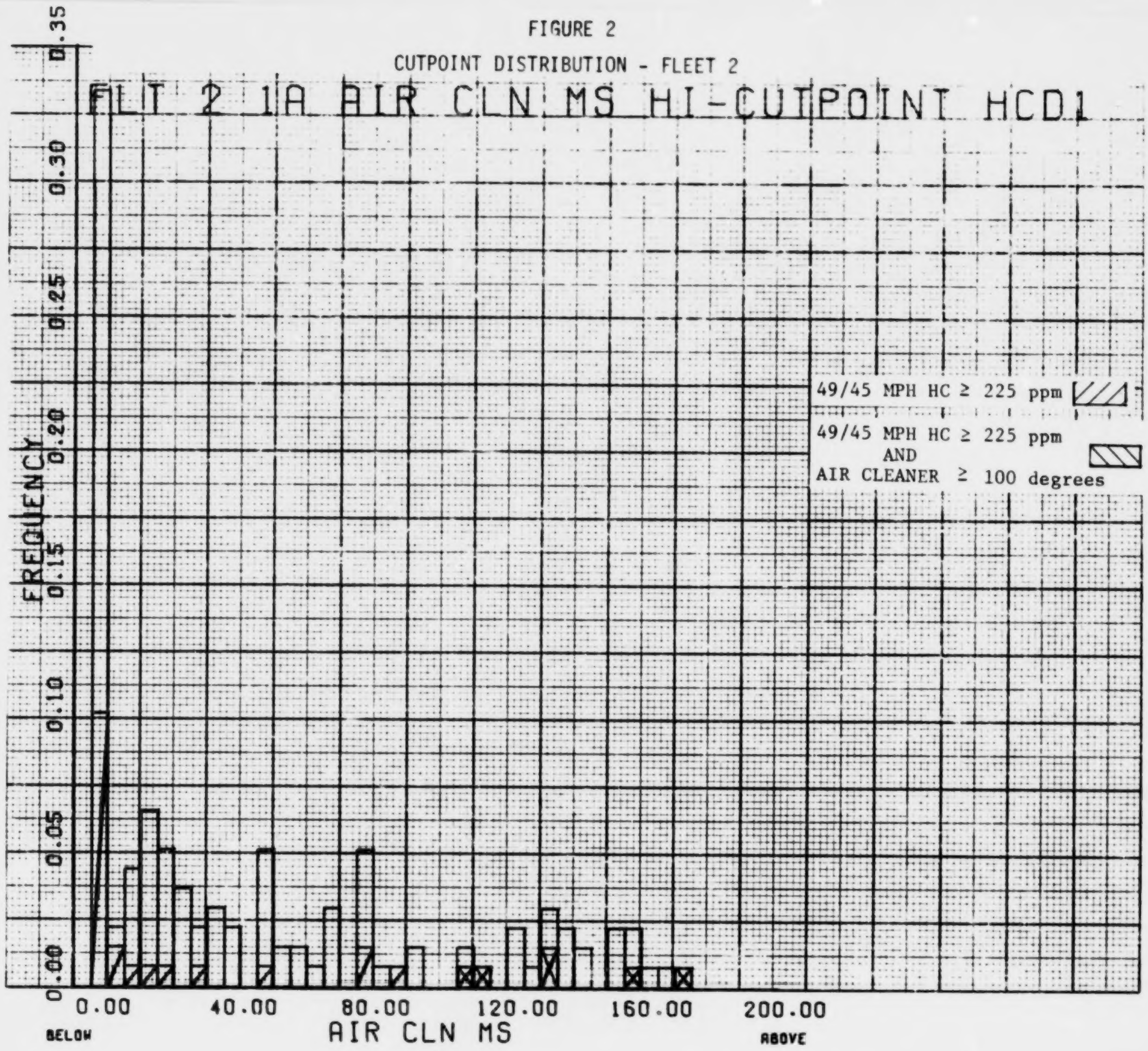

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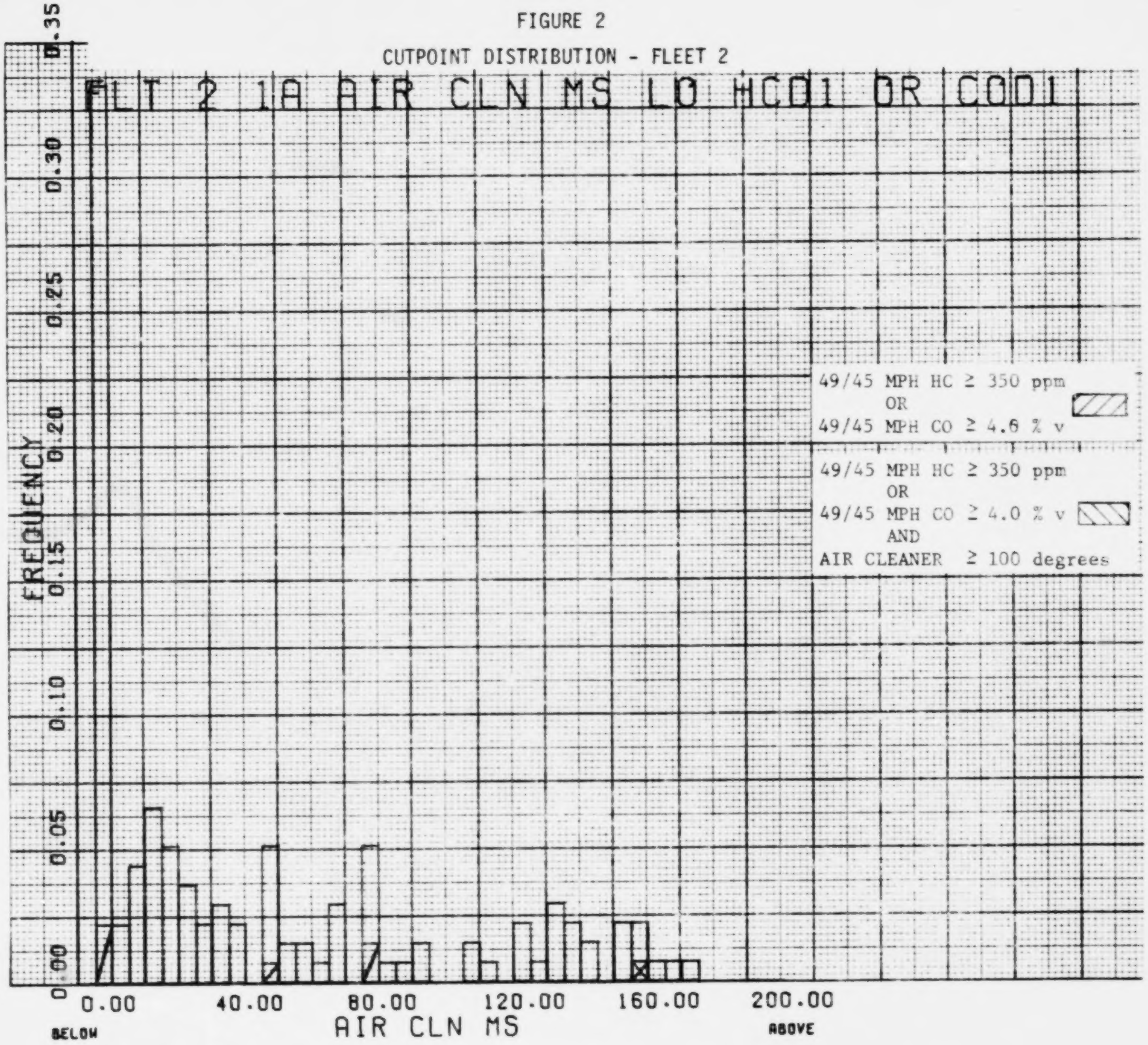

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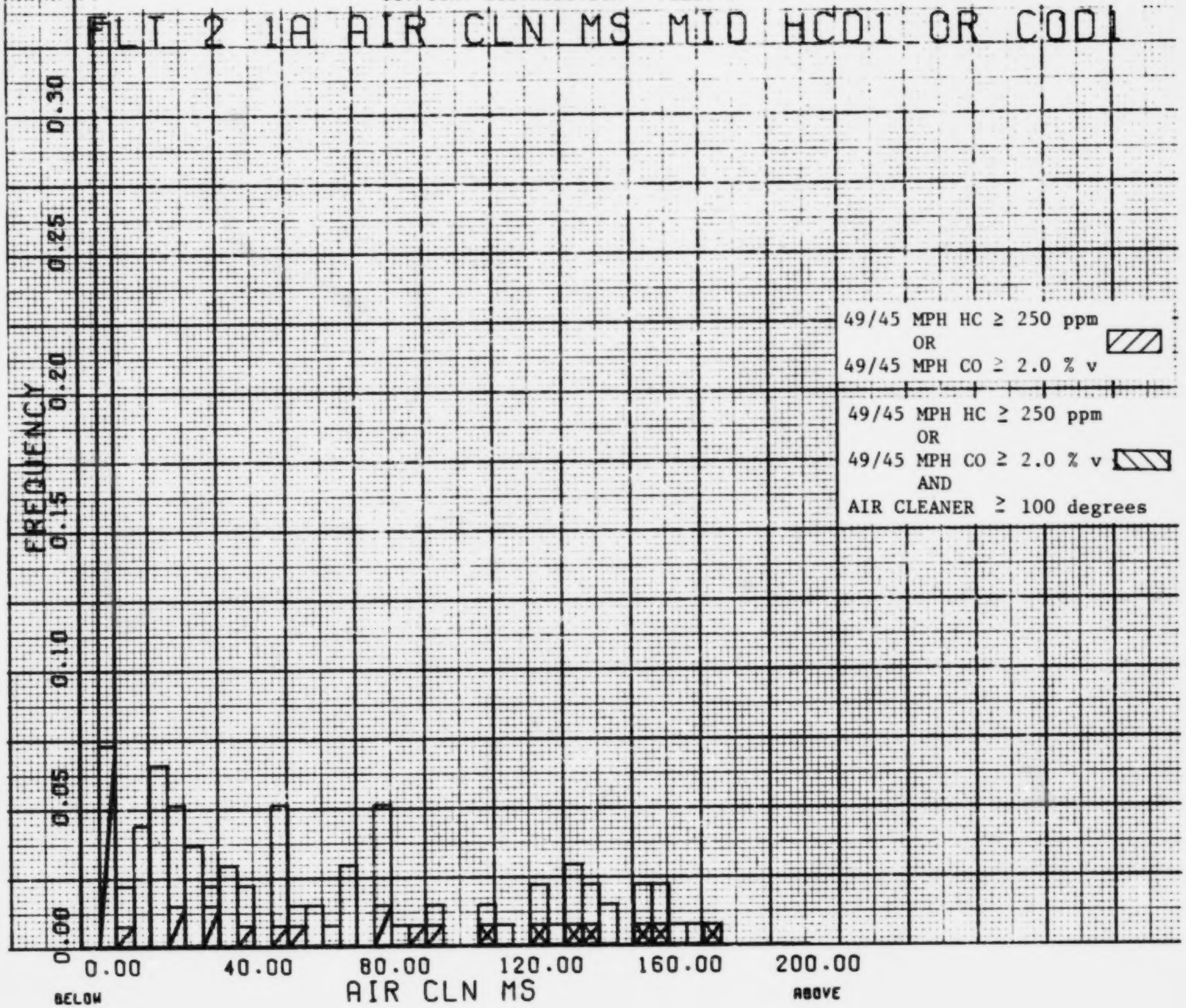

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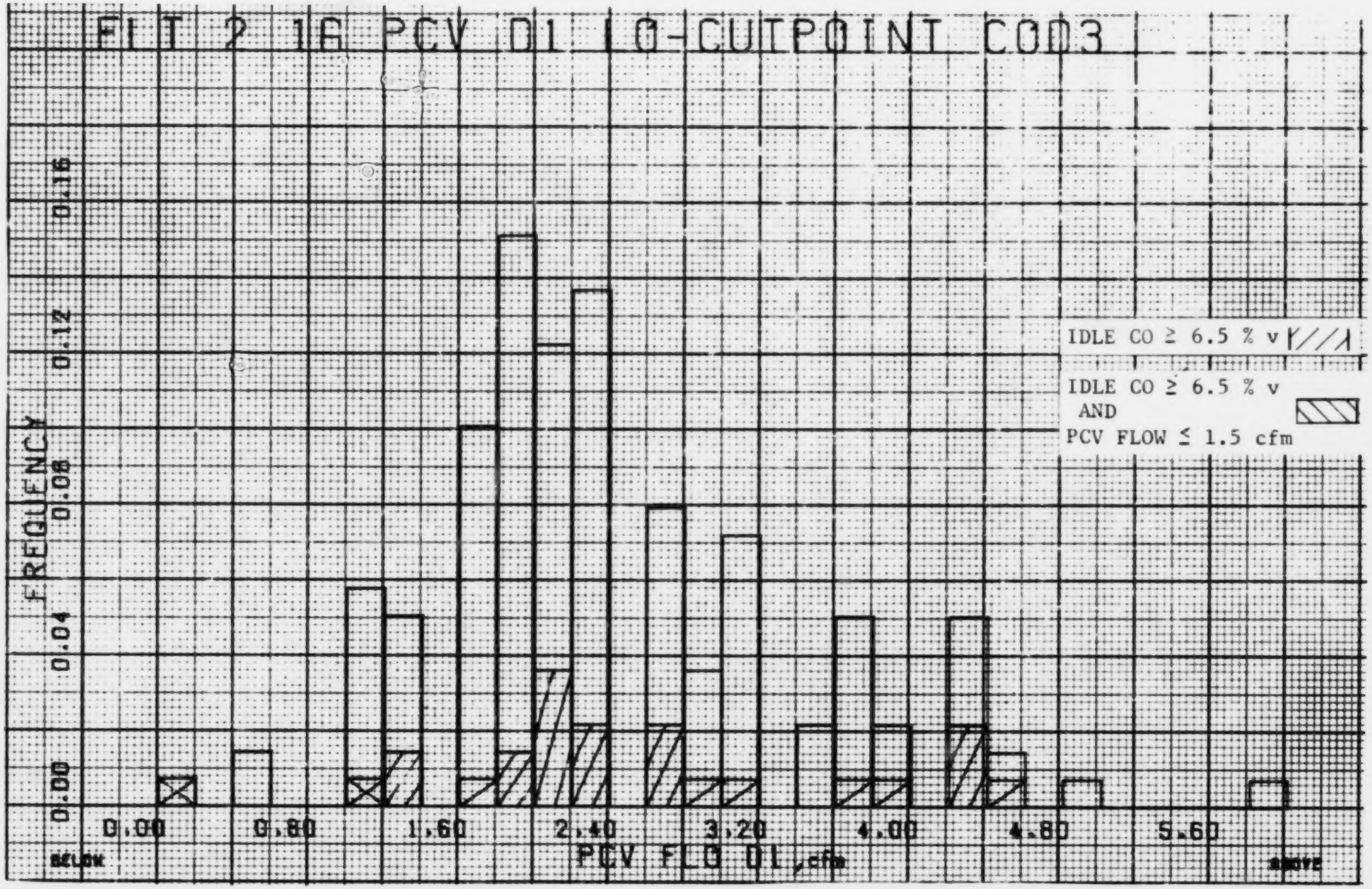

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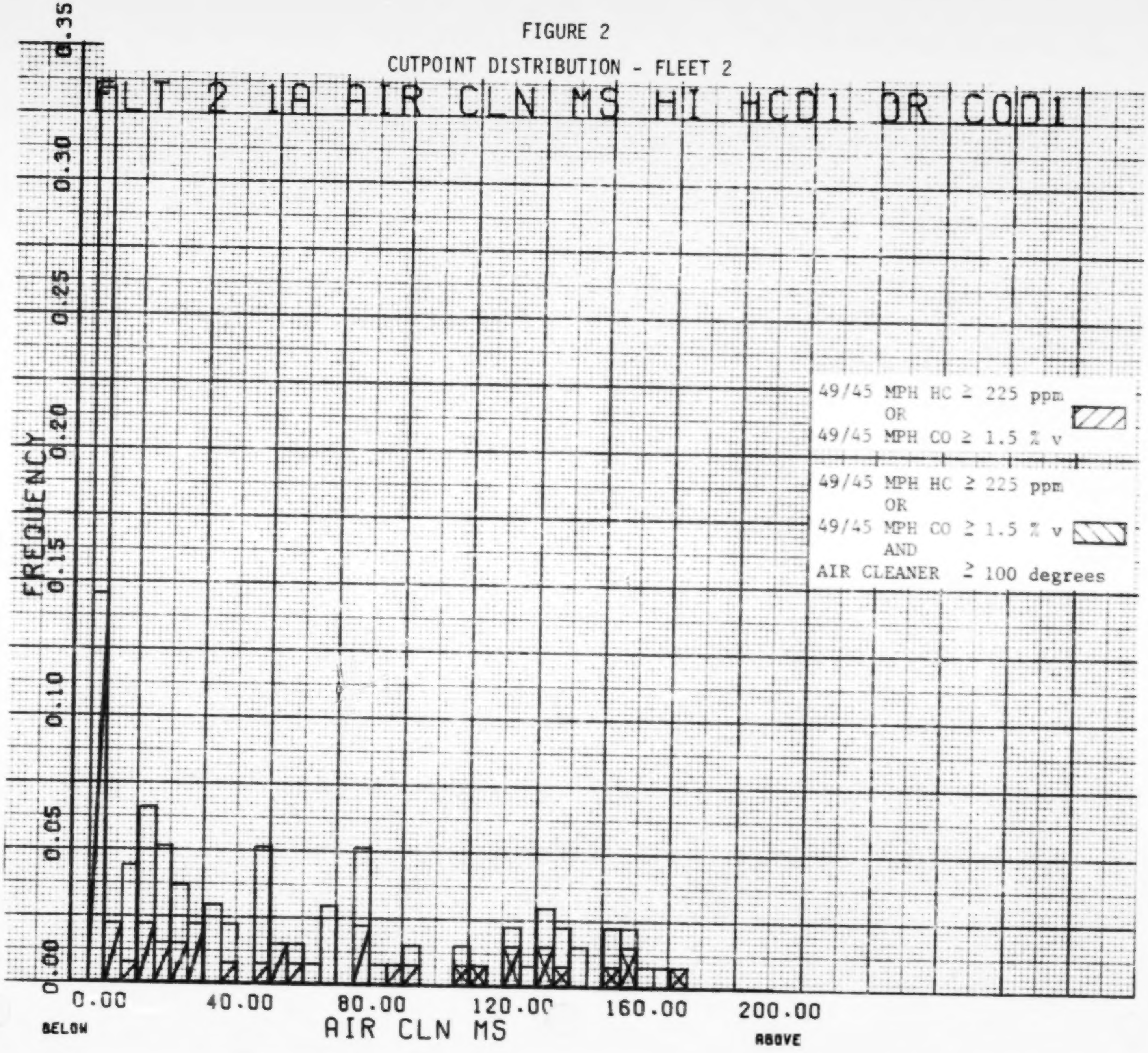


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

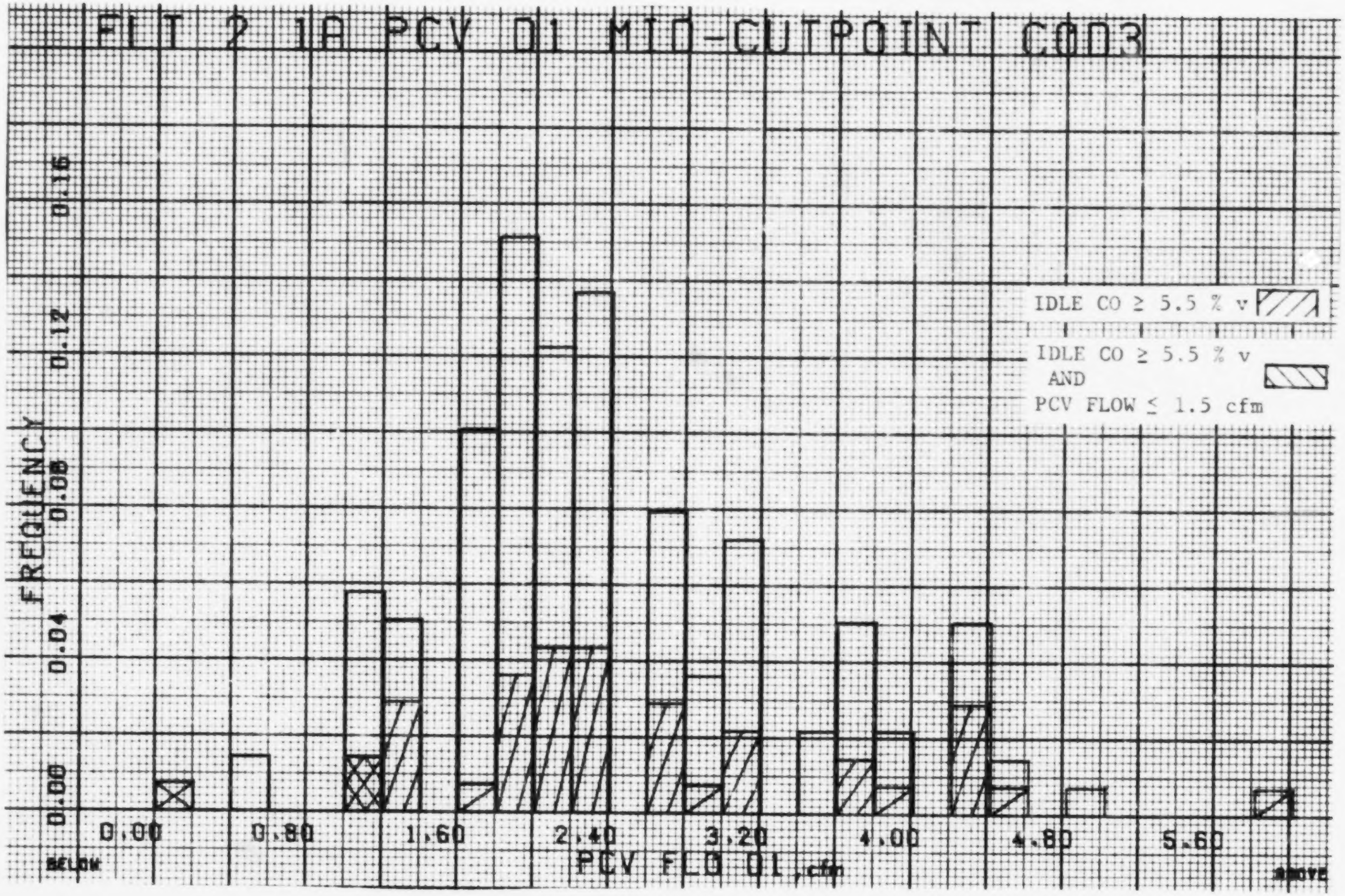


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

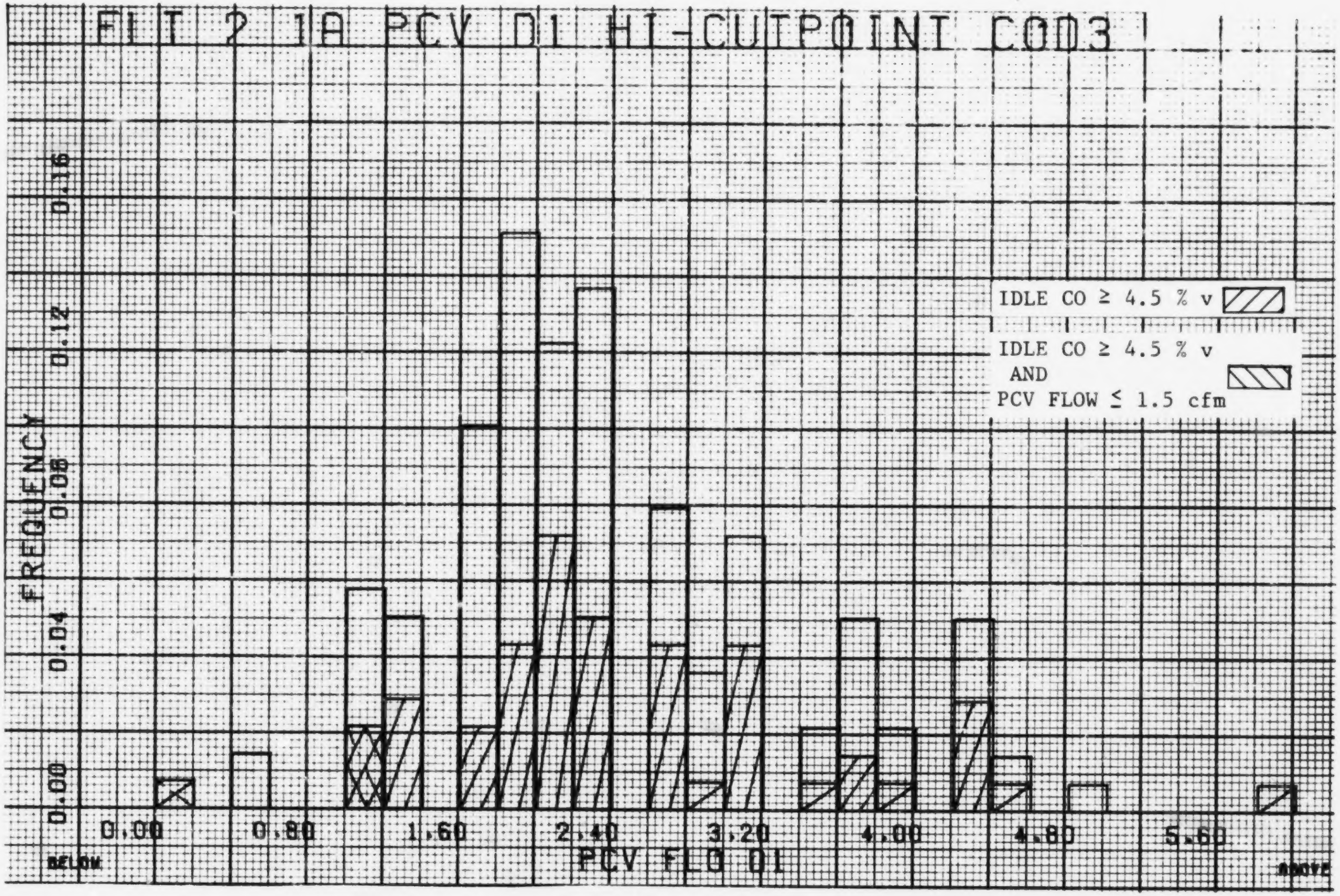


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

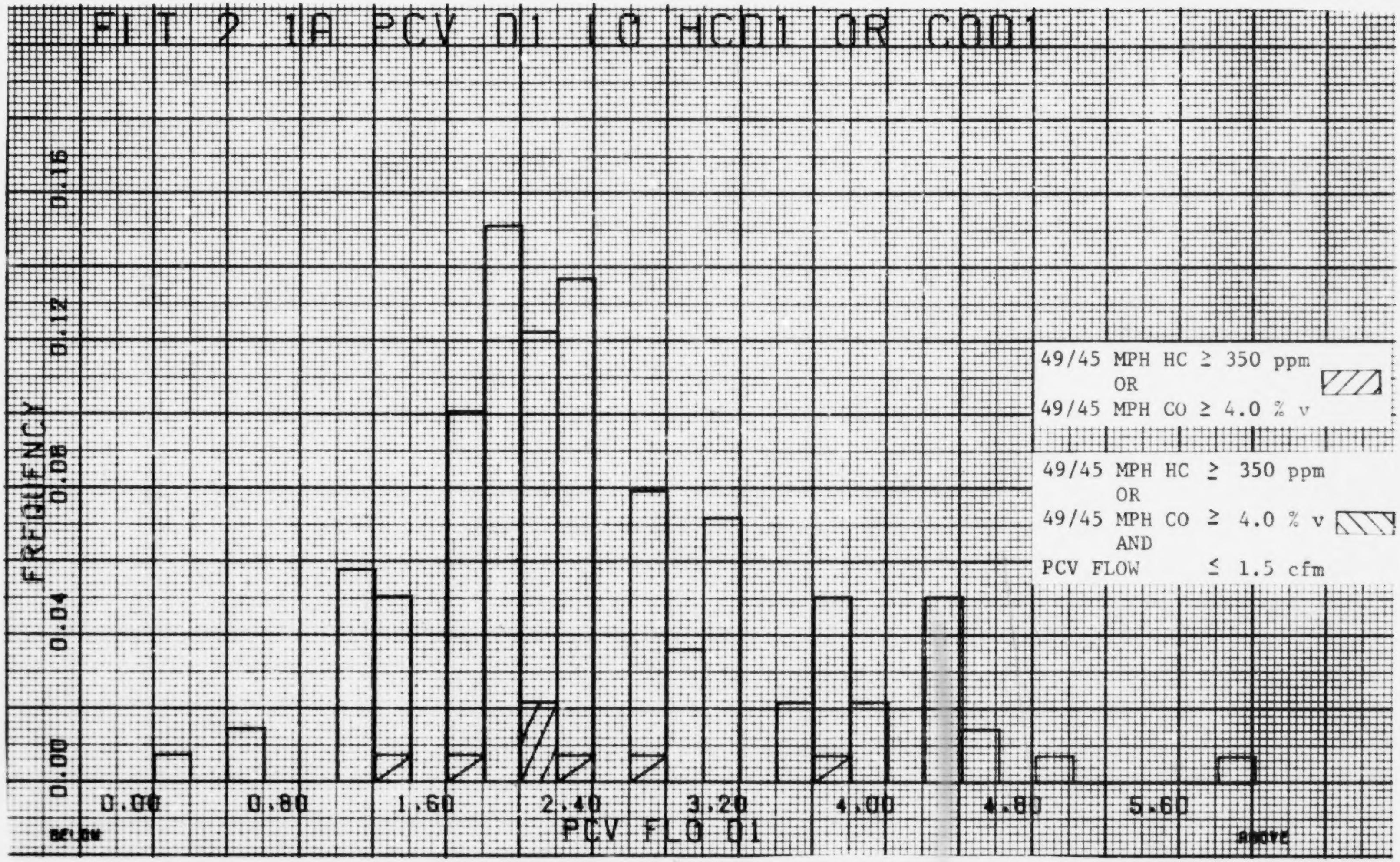


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

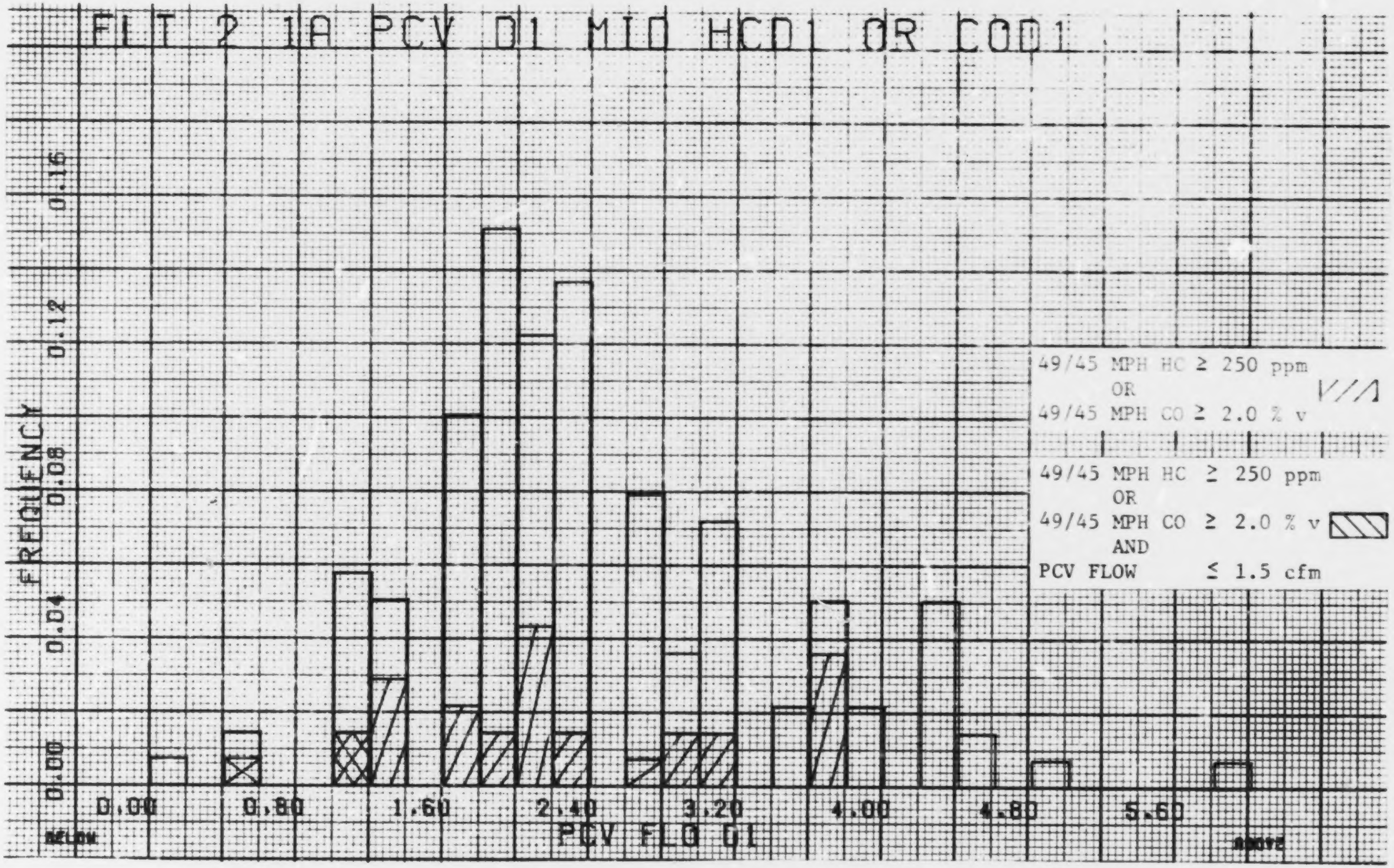


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

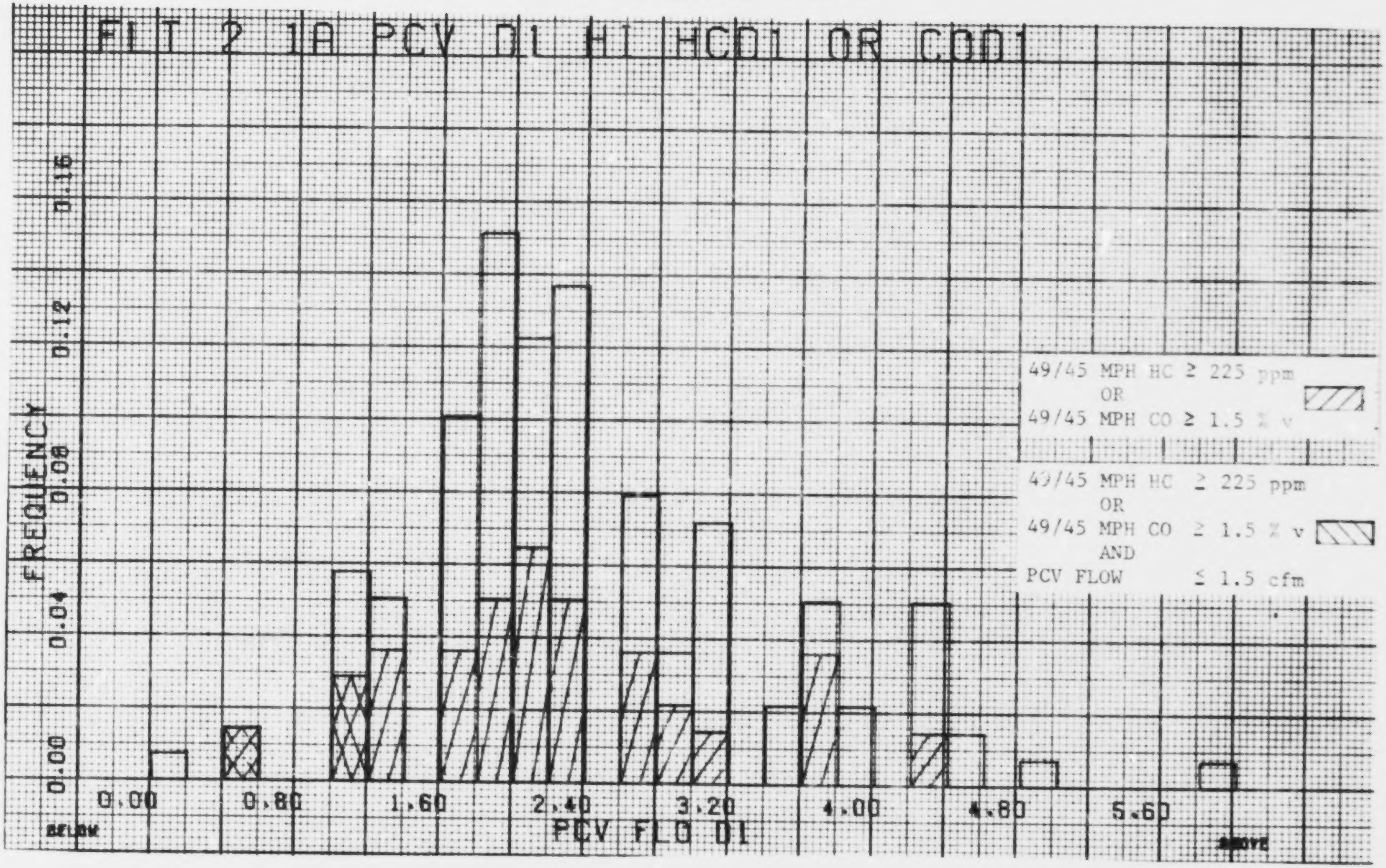


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

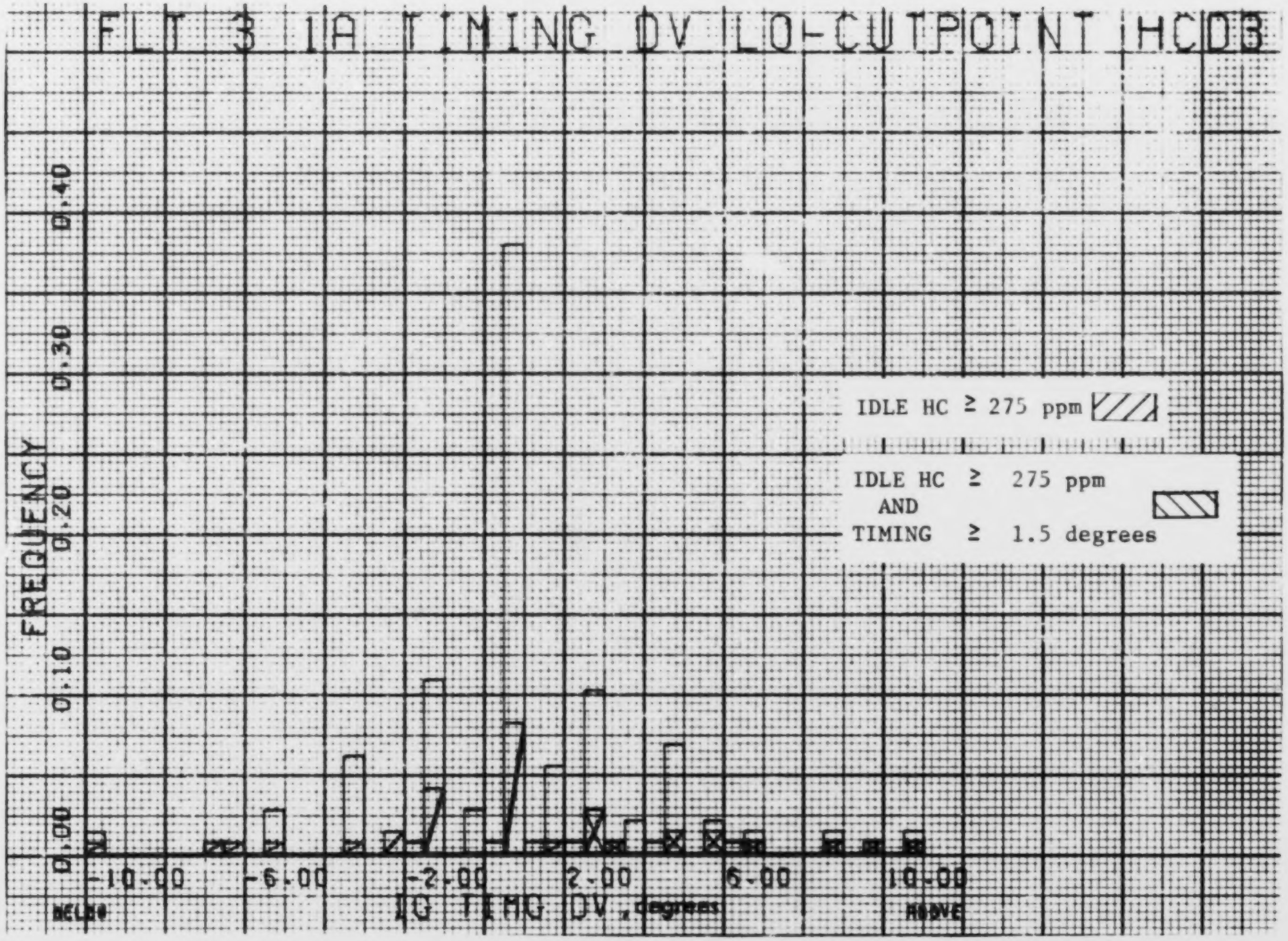


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

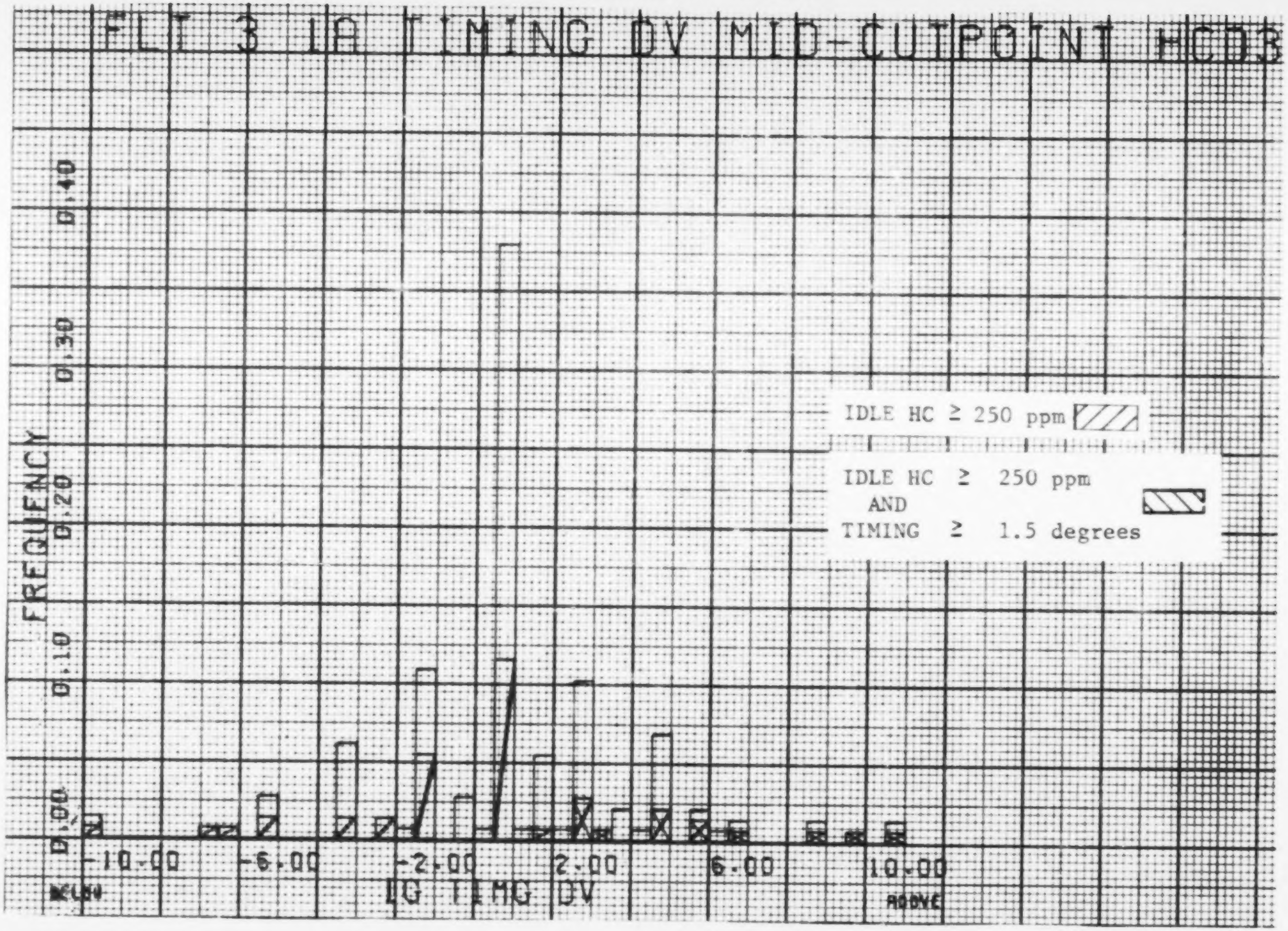


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

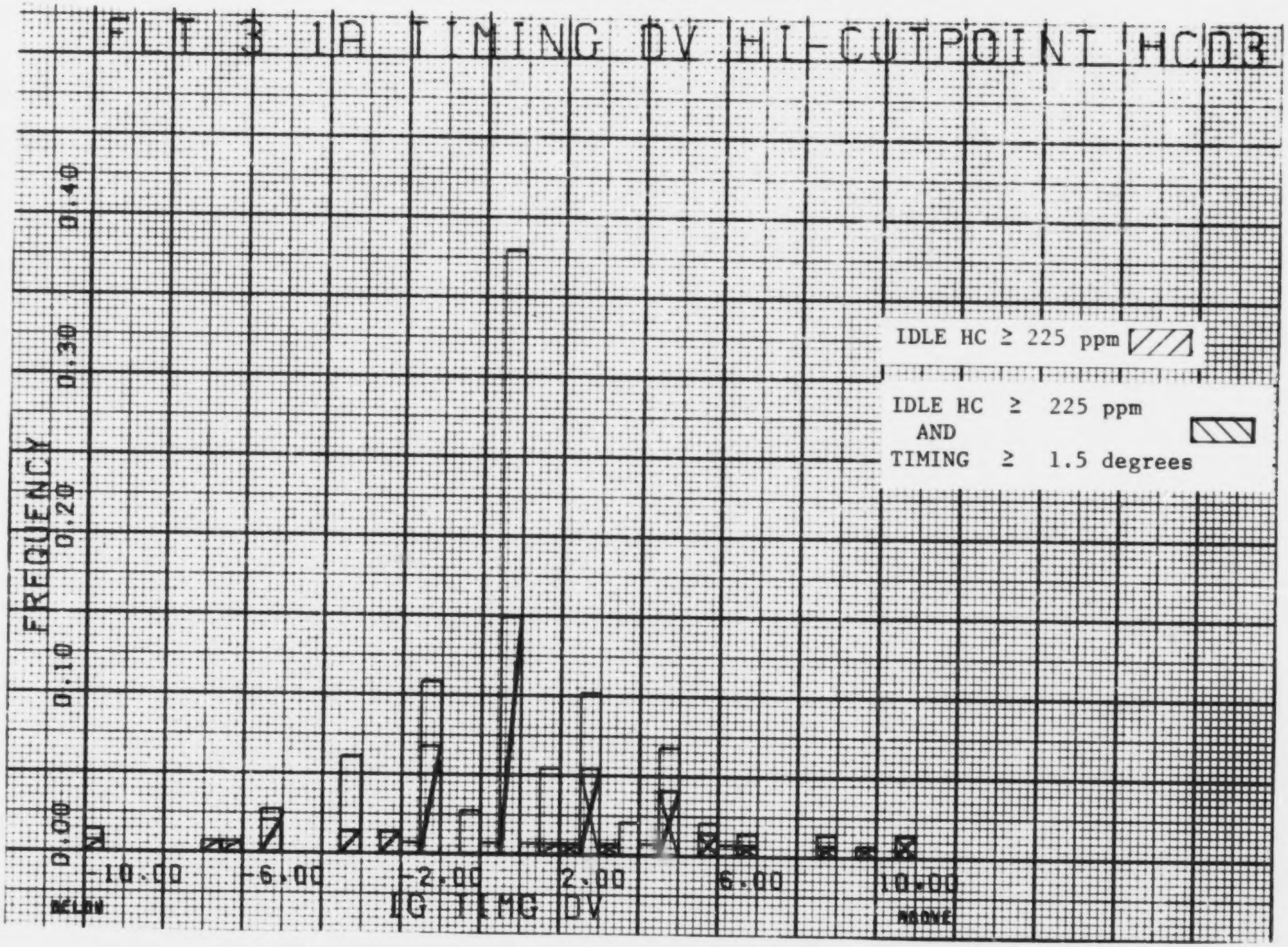


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

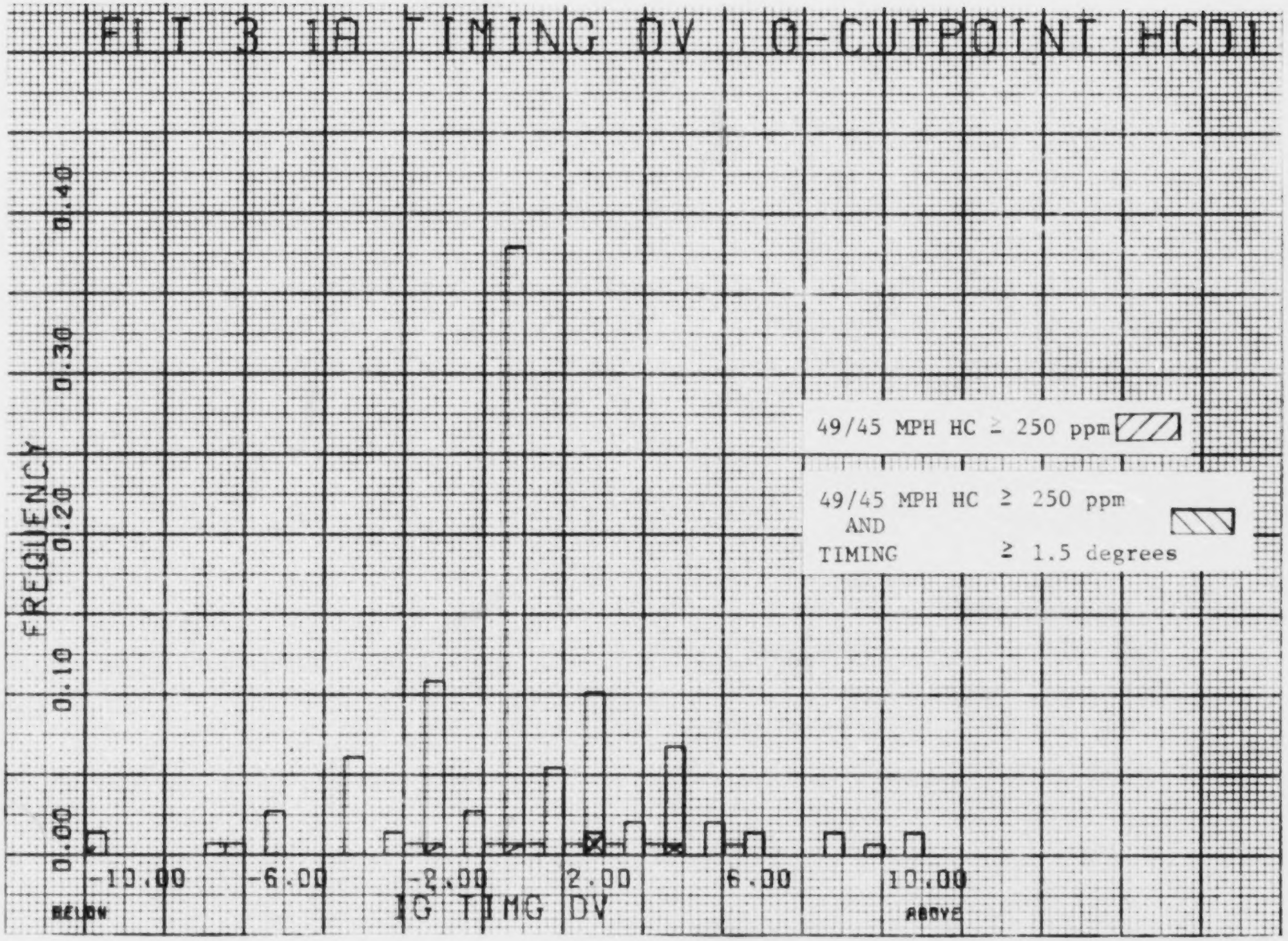


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

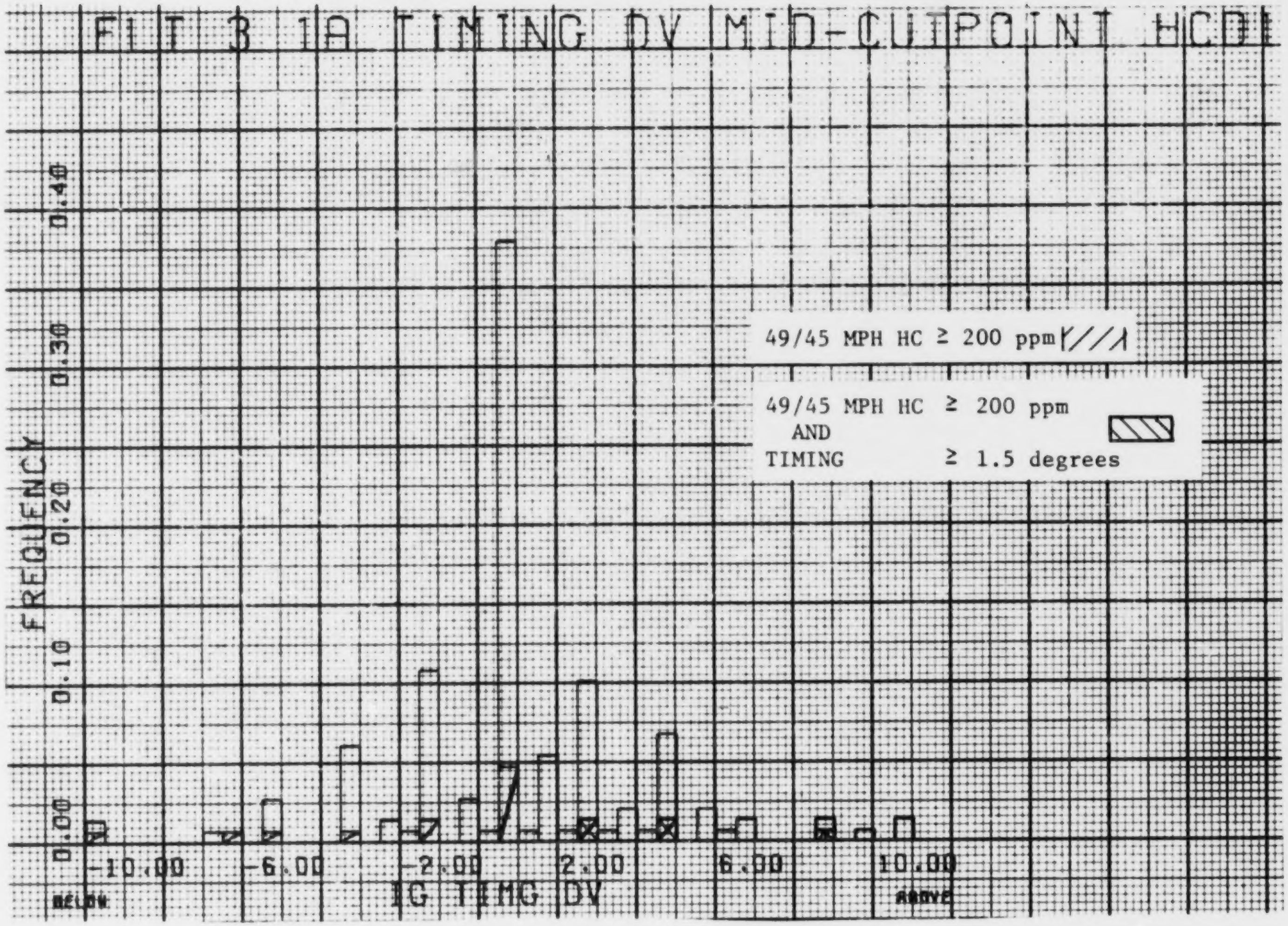


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

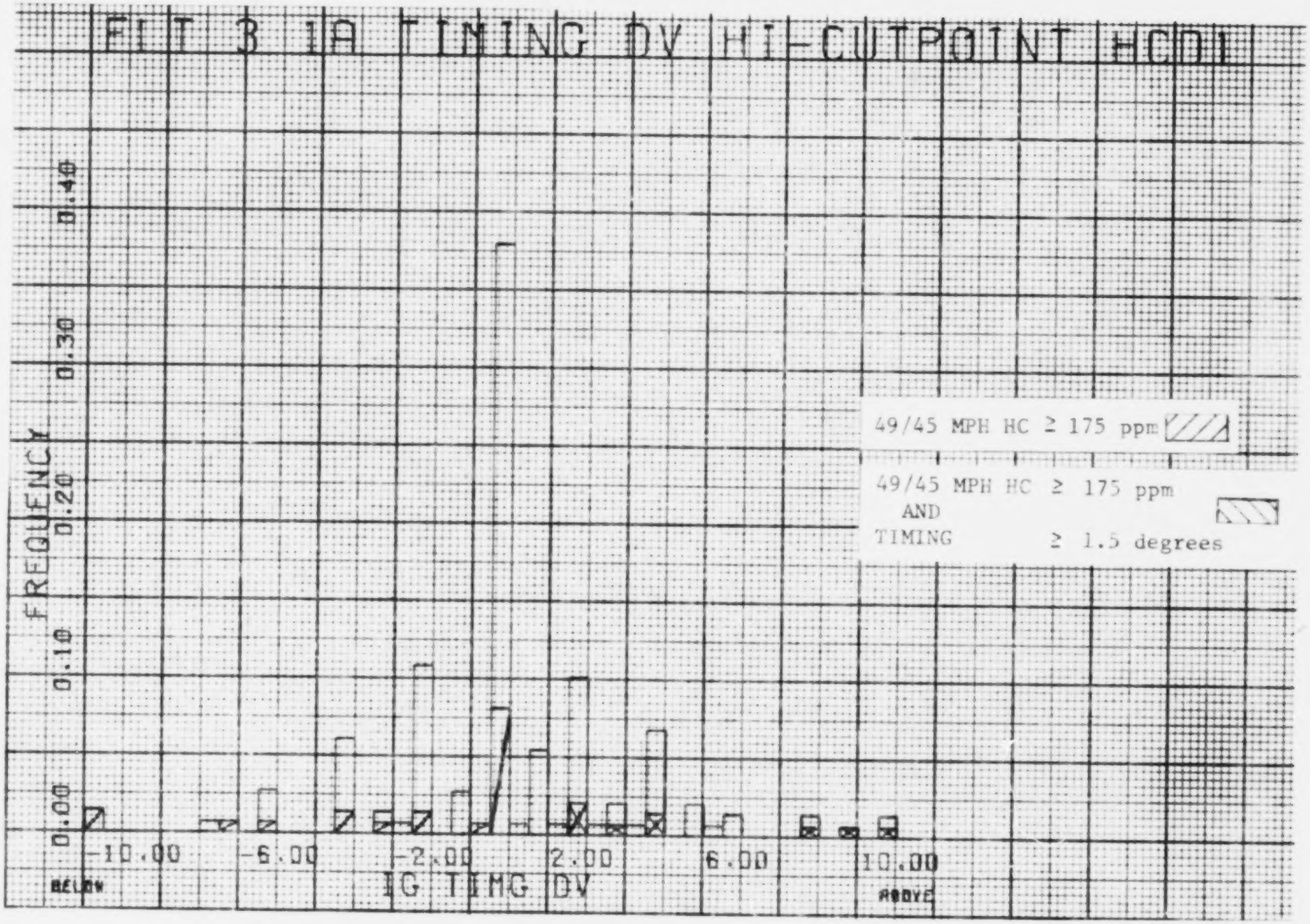


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

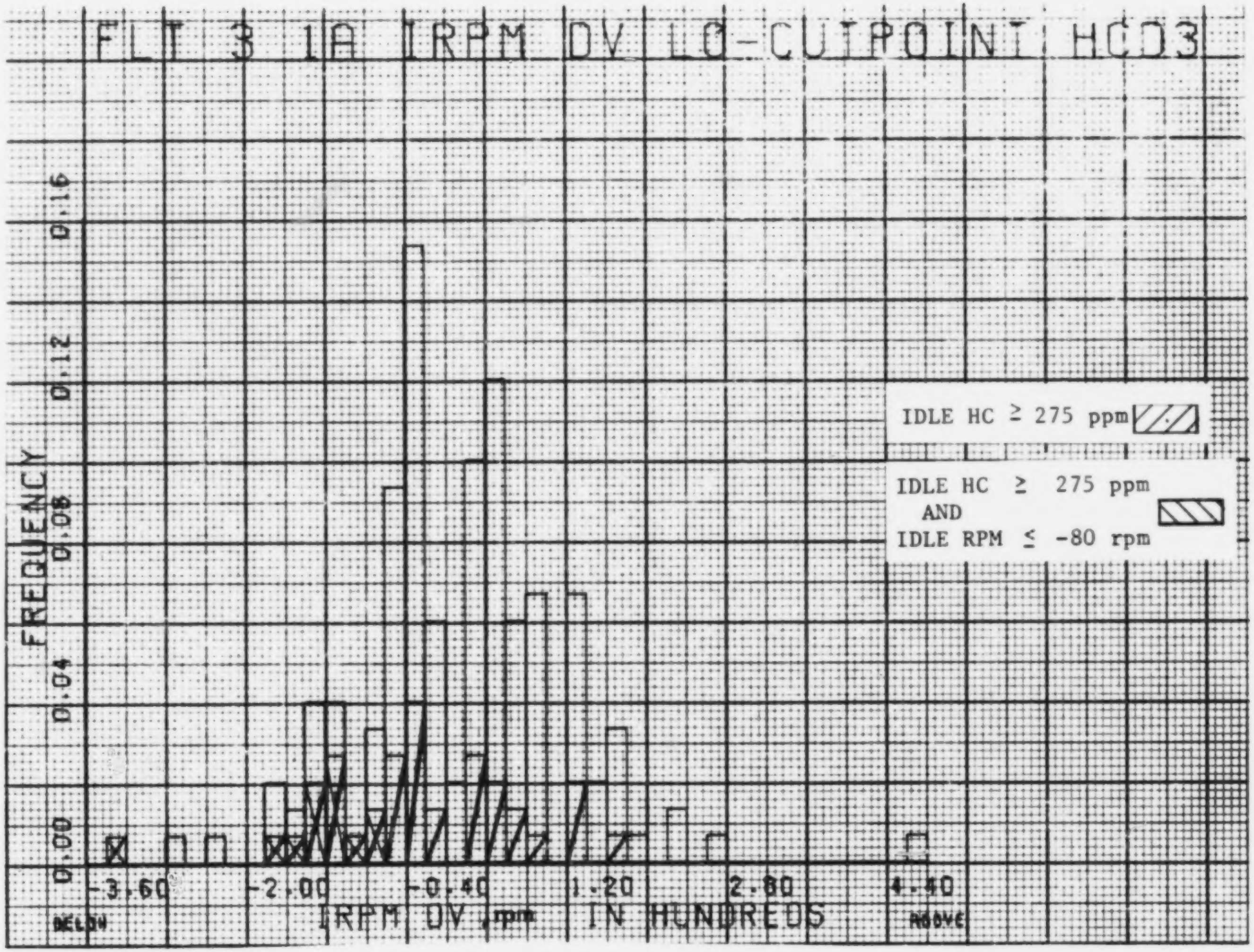


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

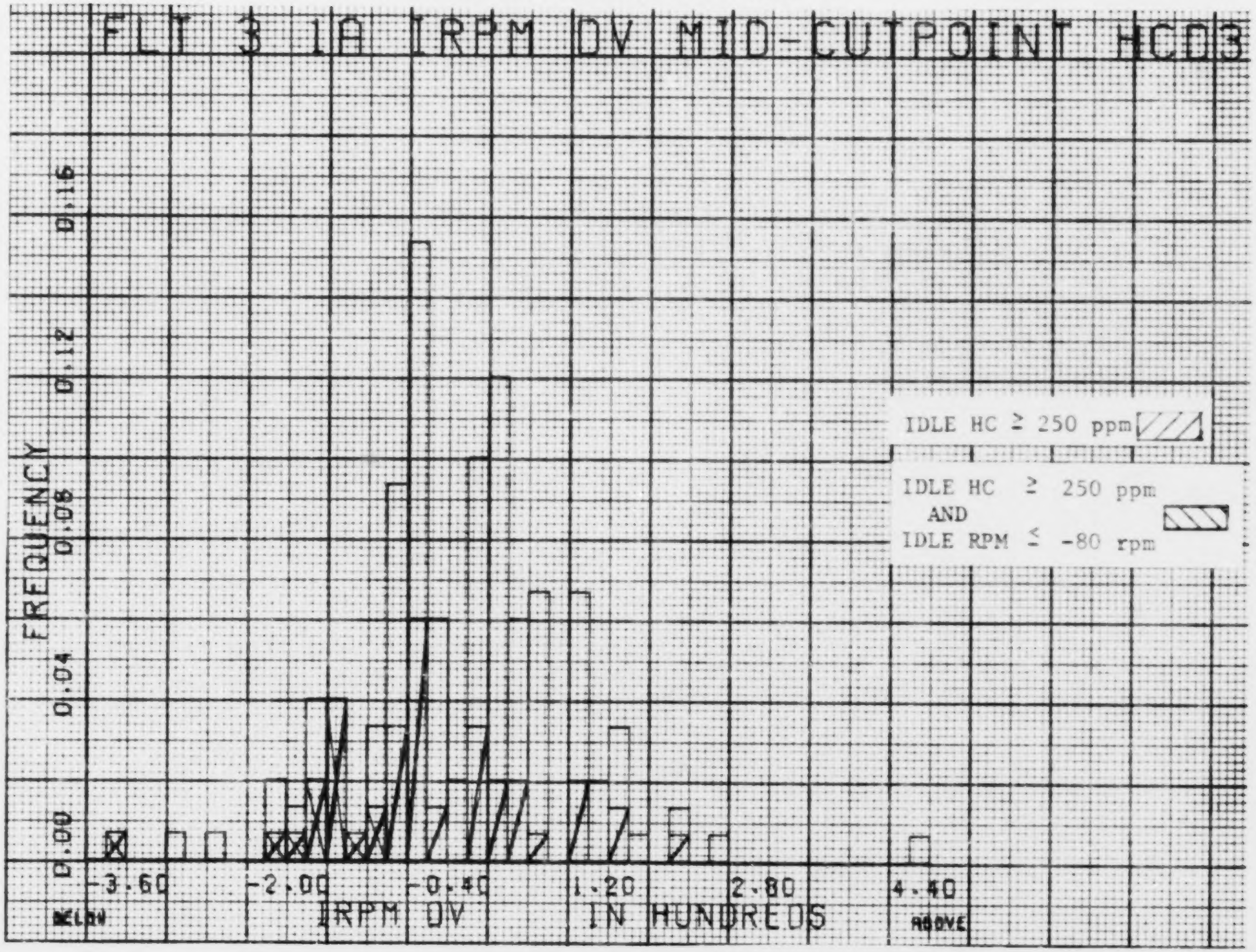


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

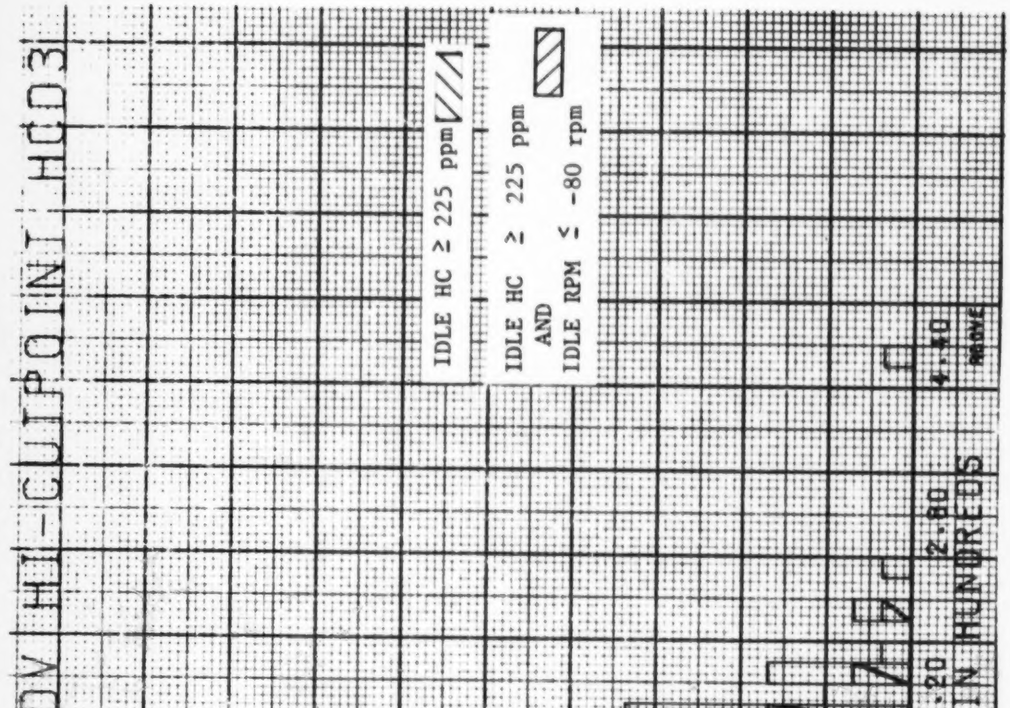


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

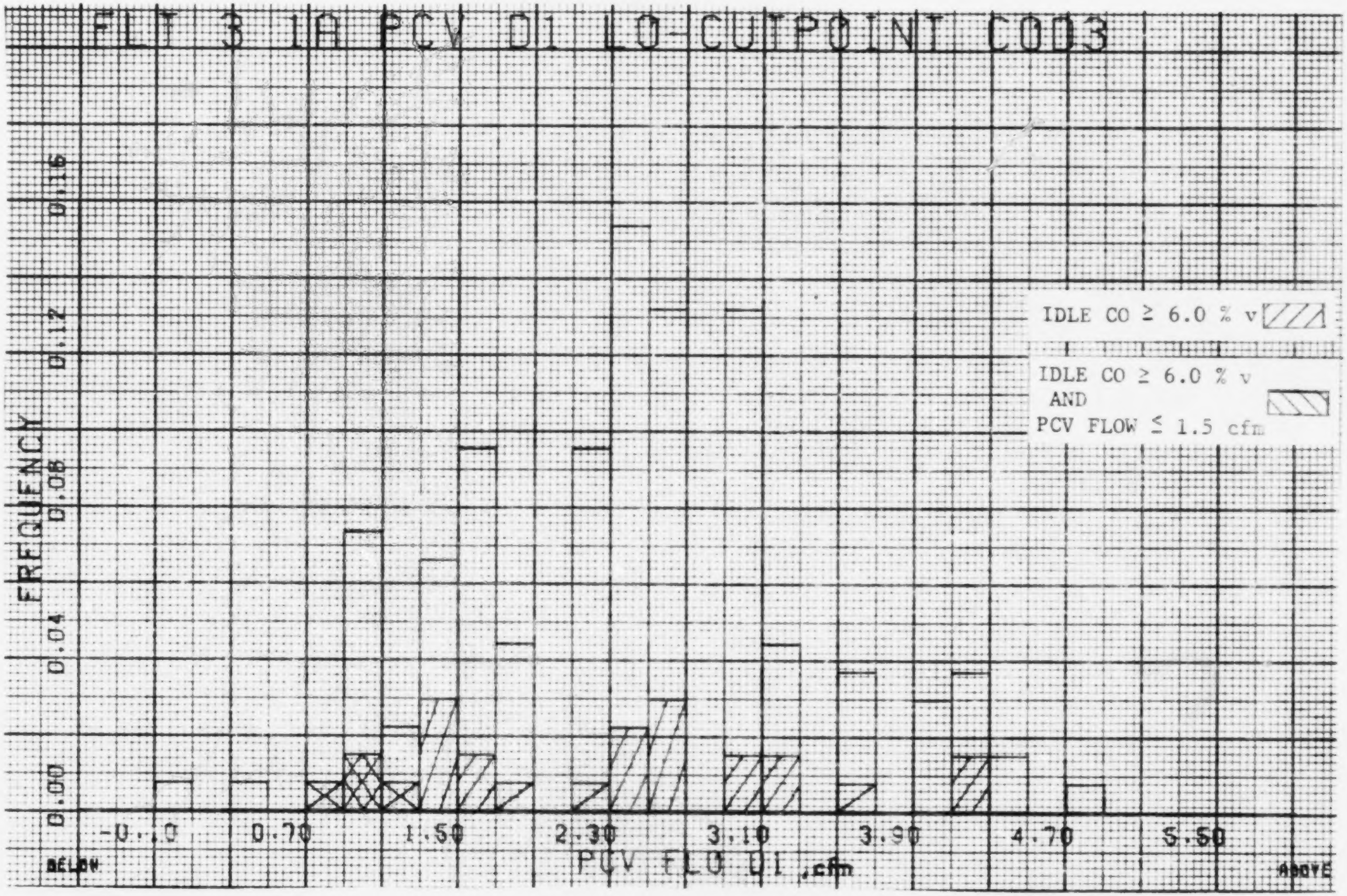


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

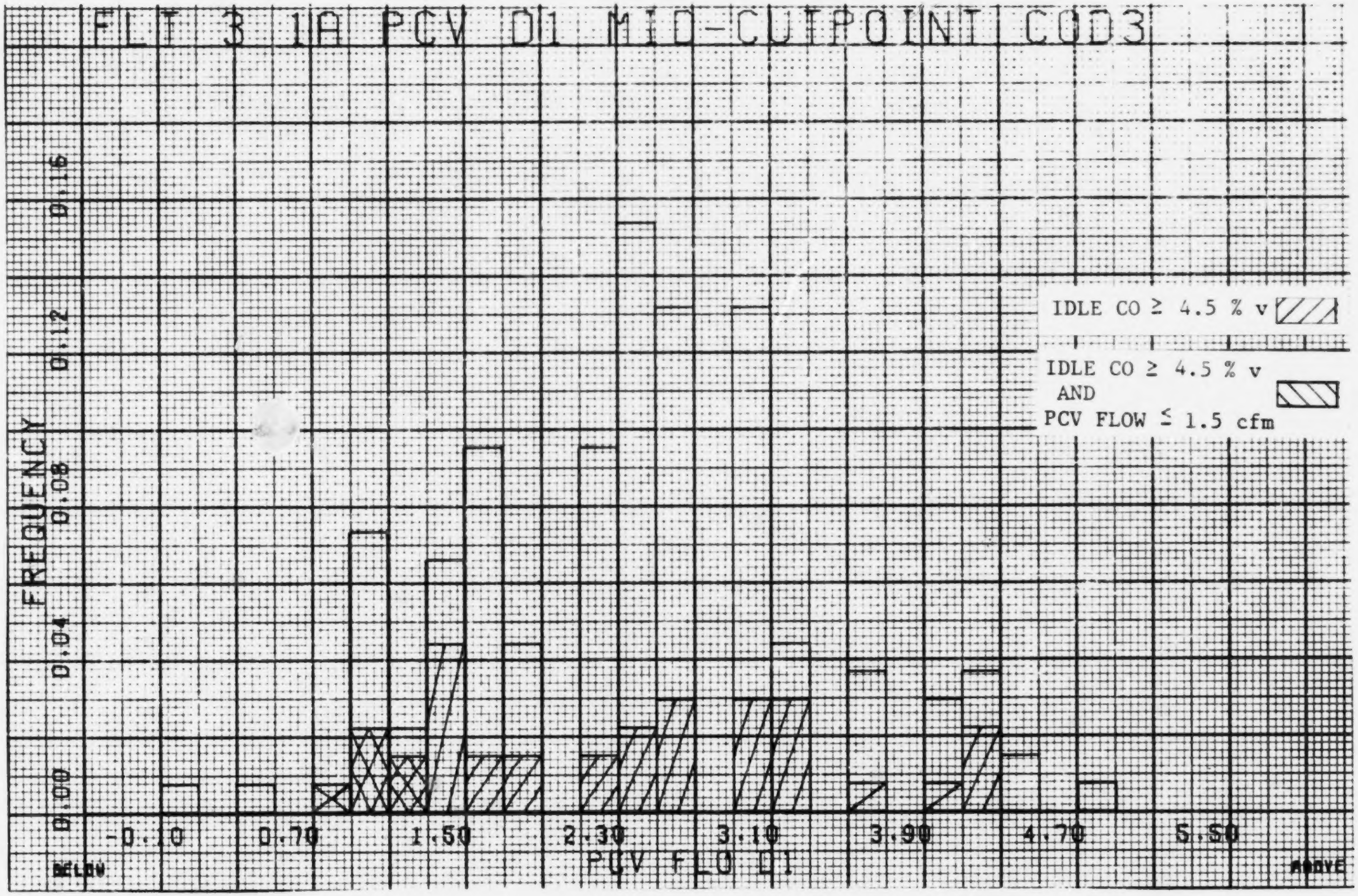


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

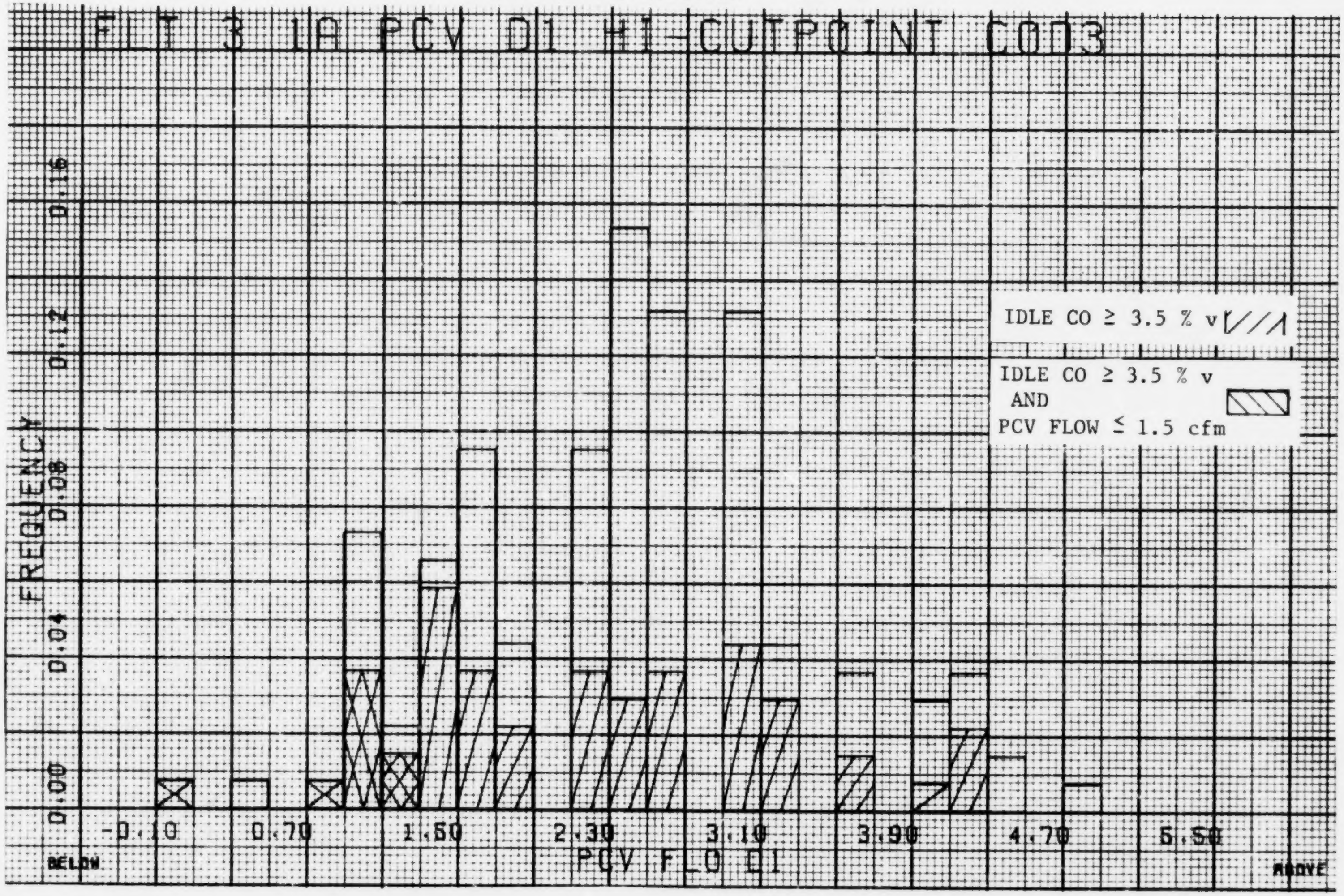


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

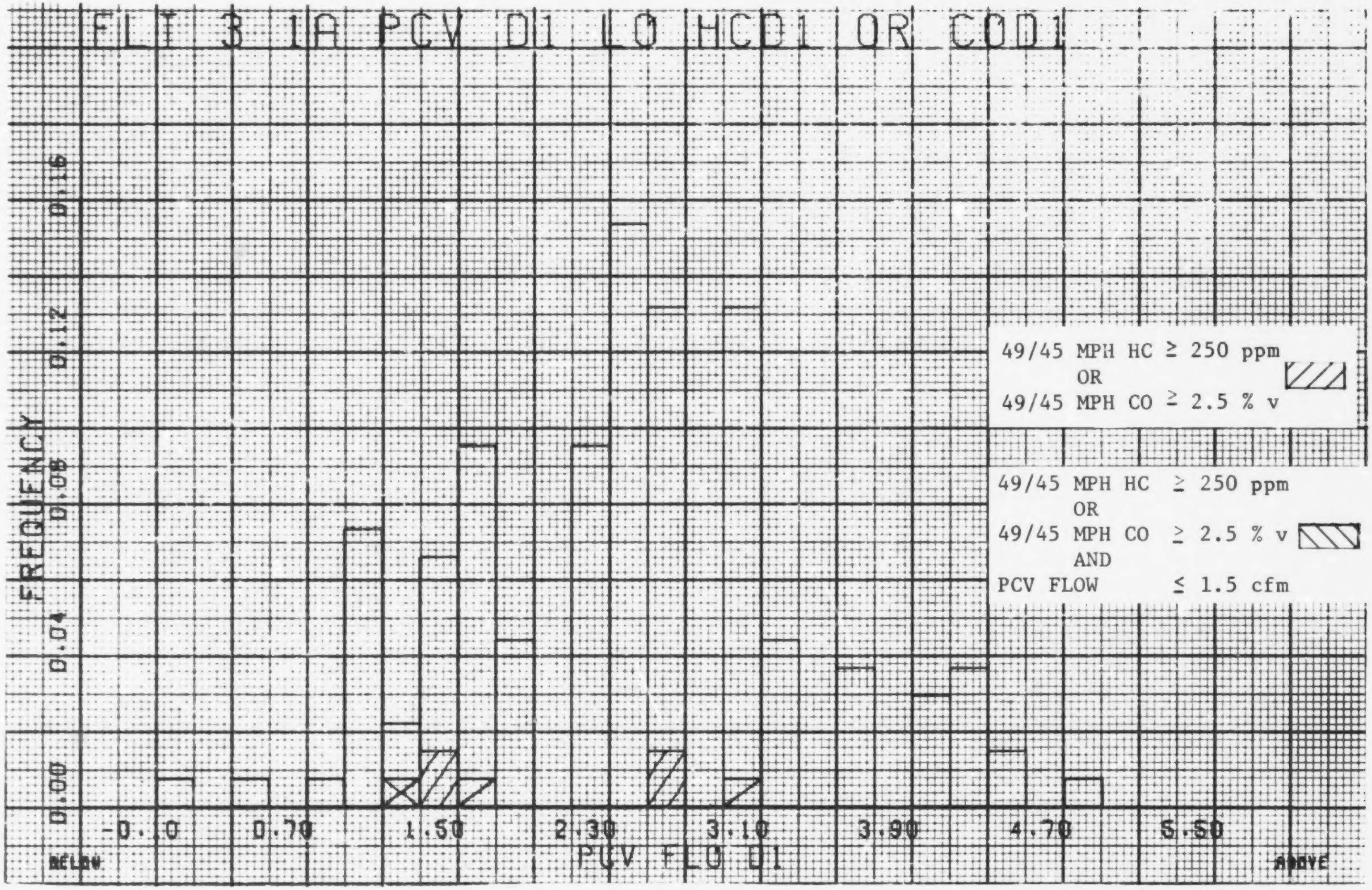


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

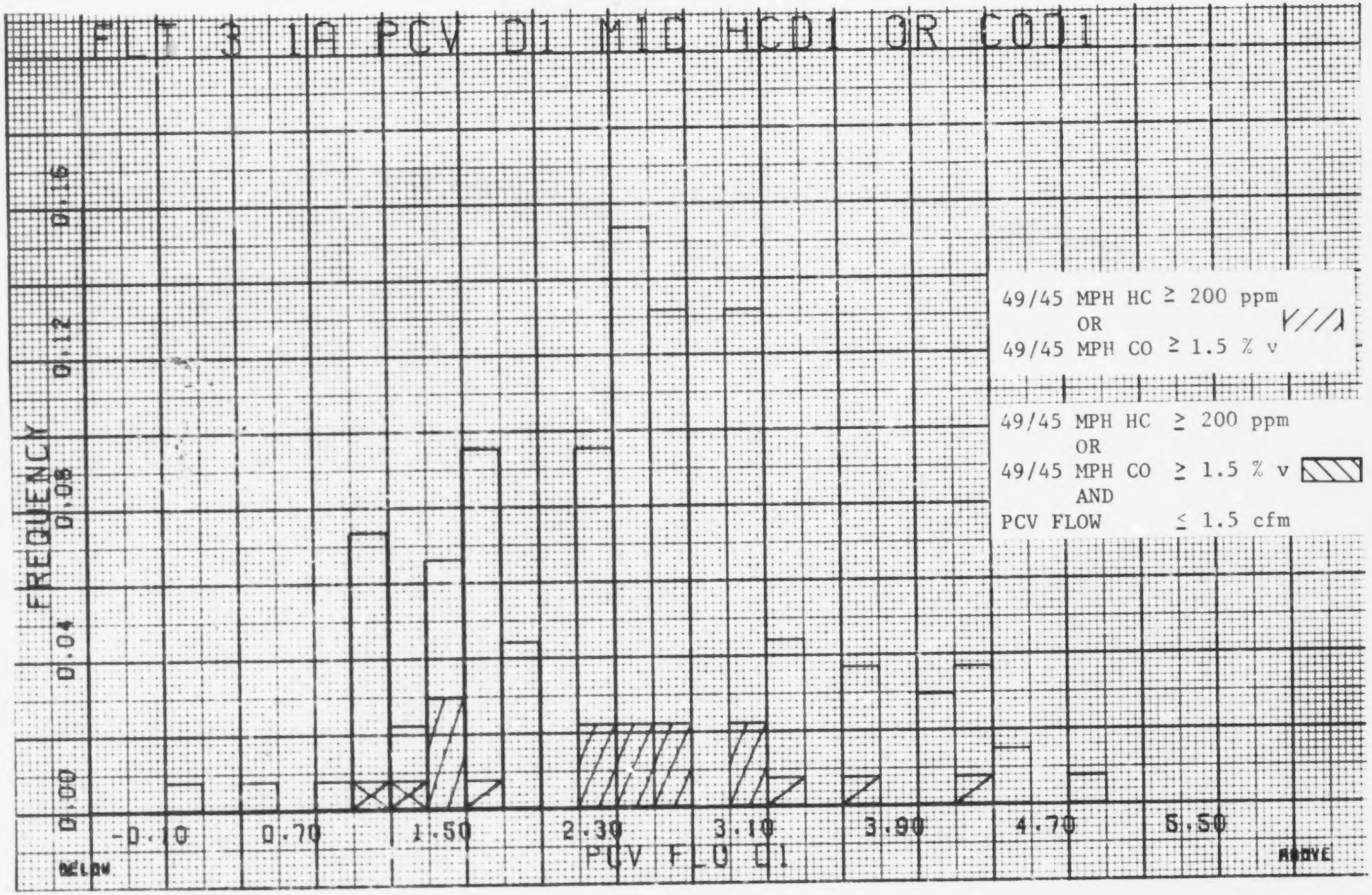


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

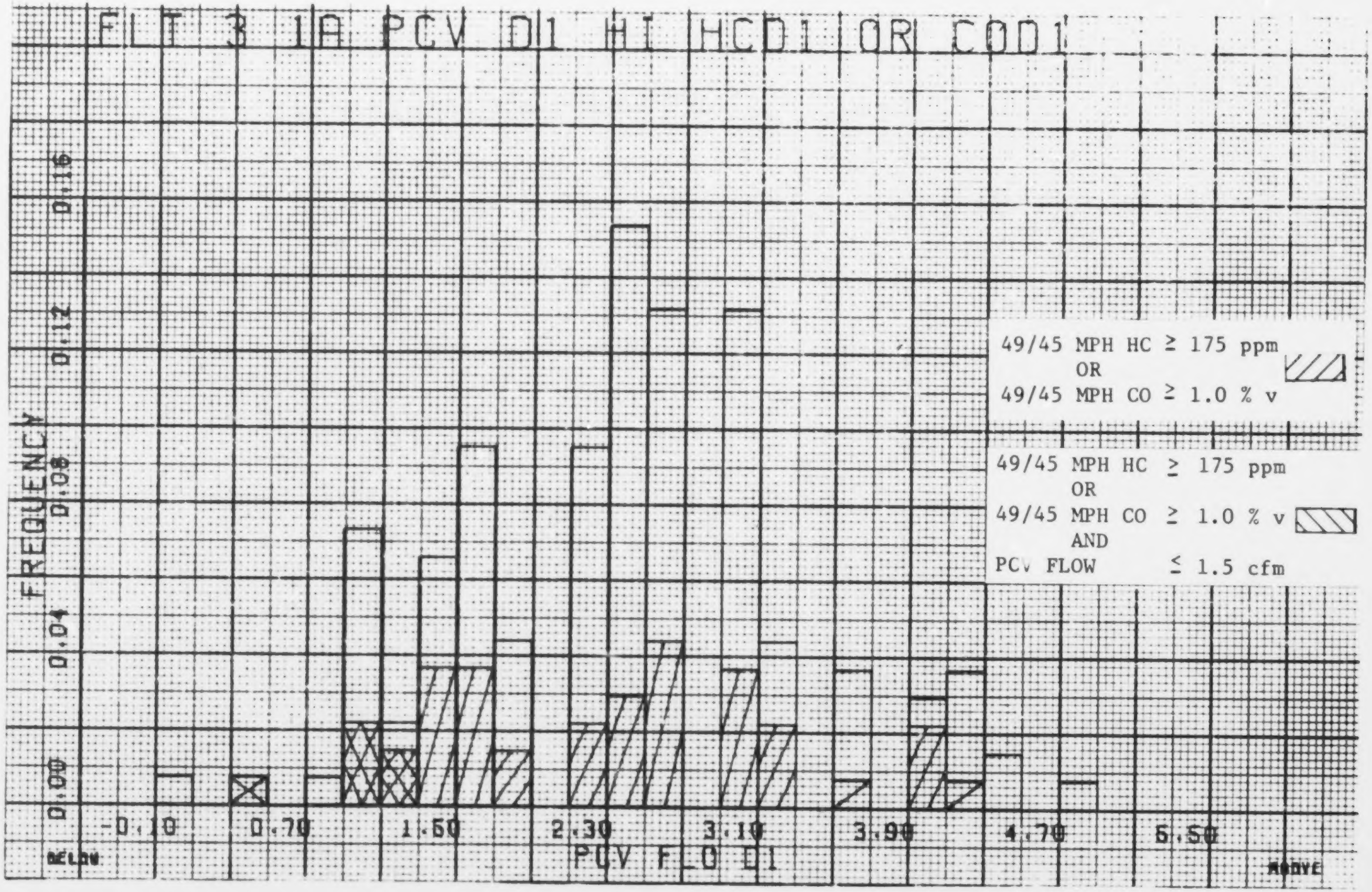


FIGURE 3

CUTPOINT DISTRIBUITON - FLEET 3

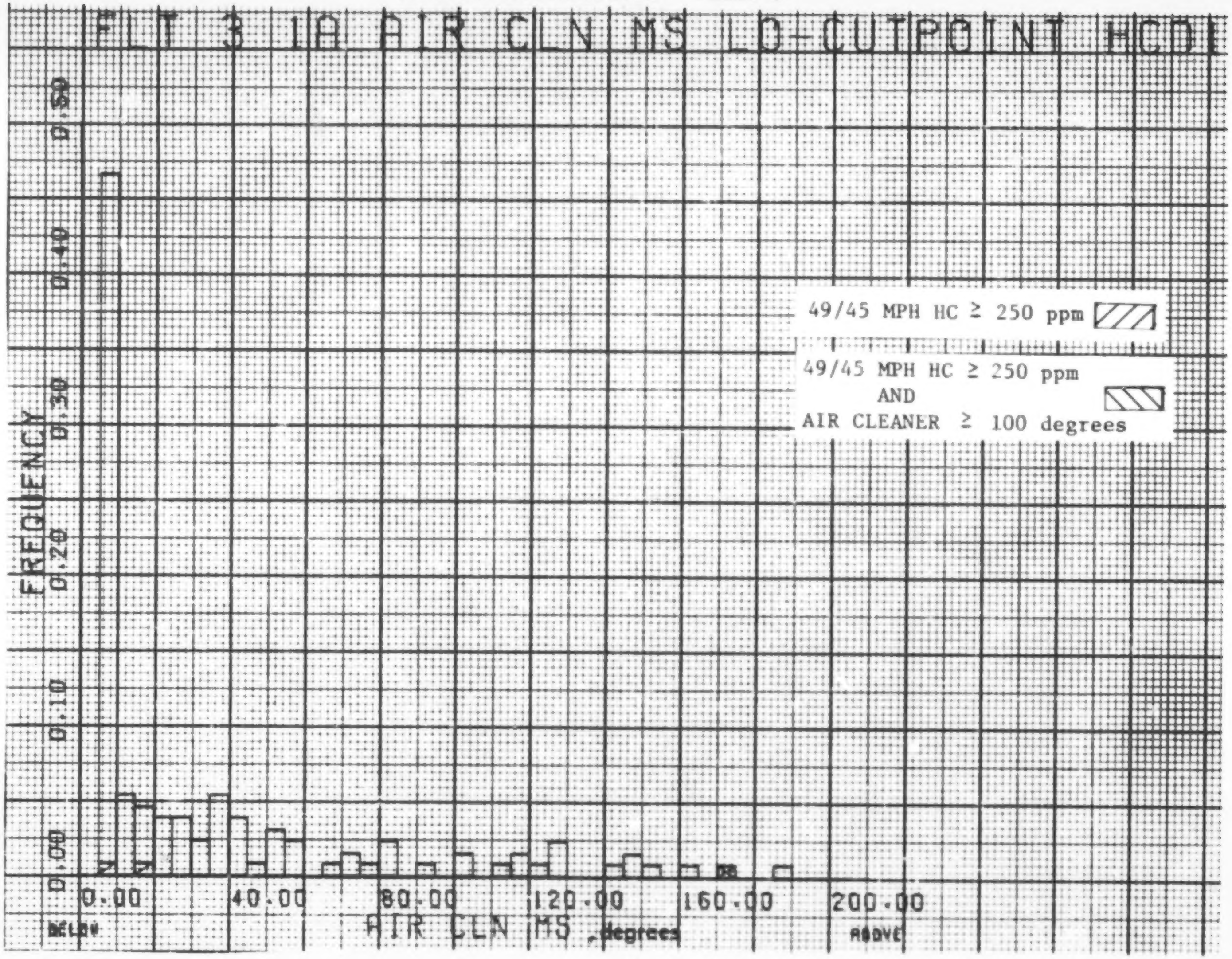


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

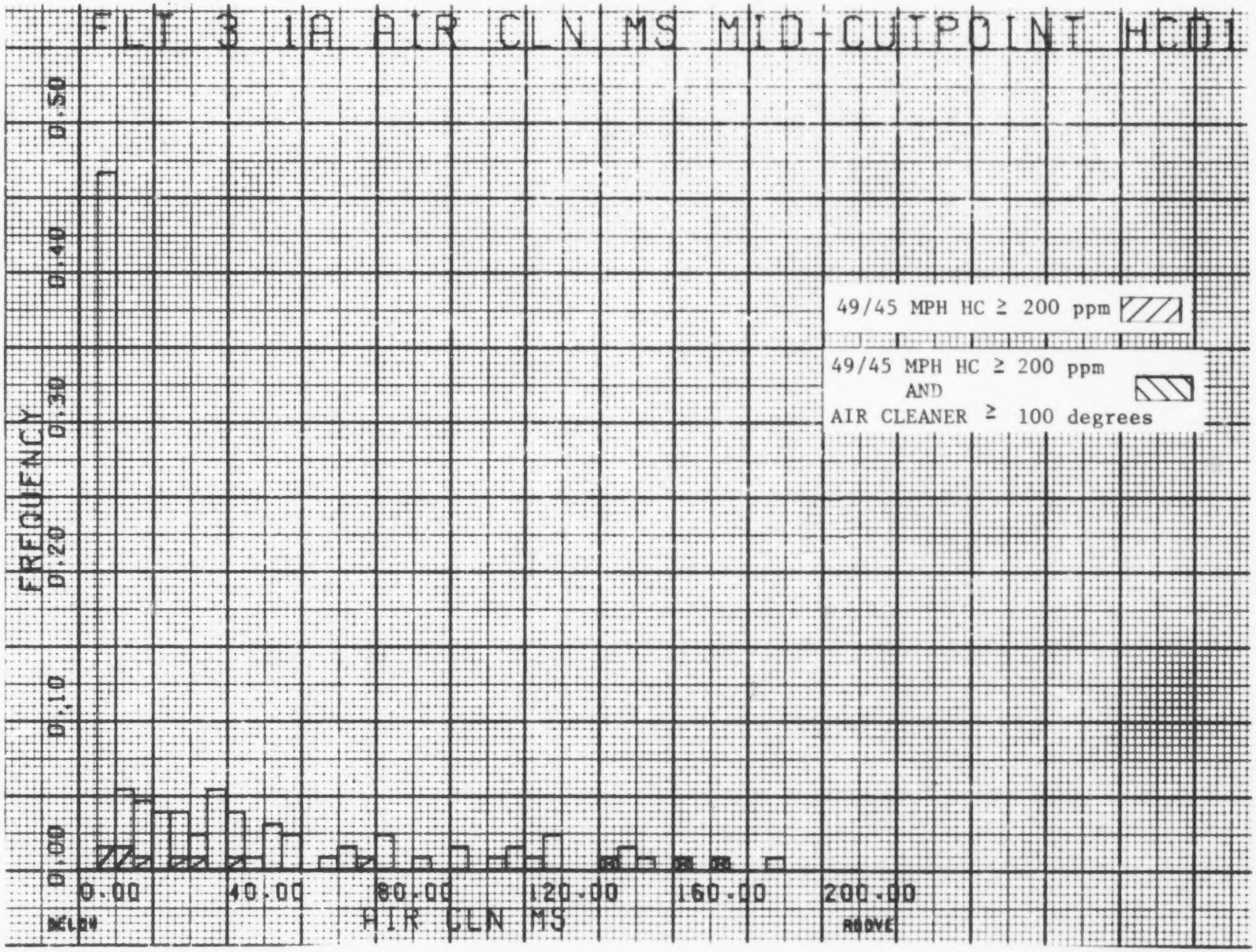


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

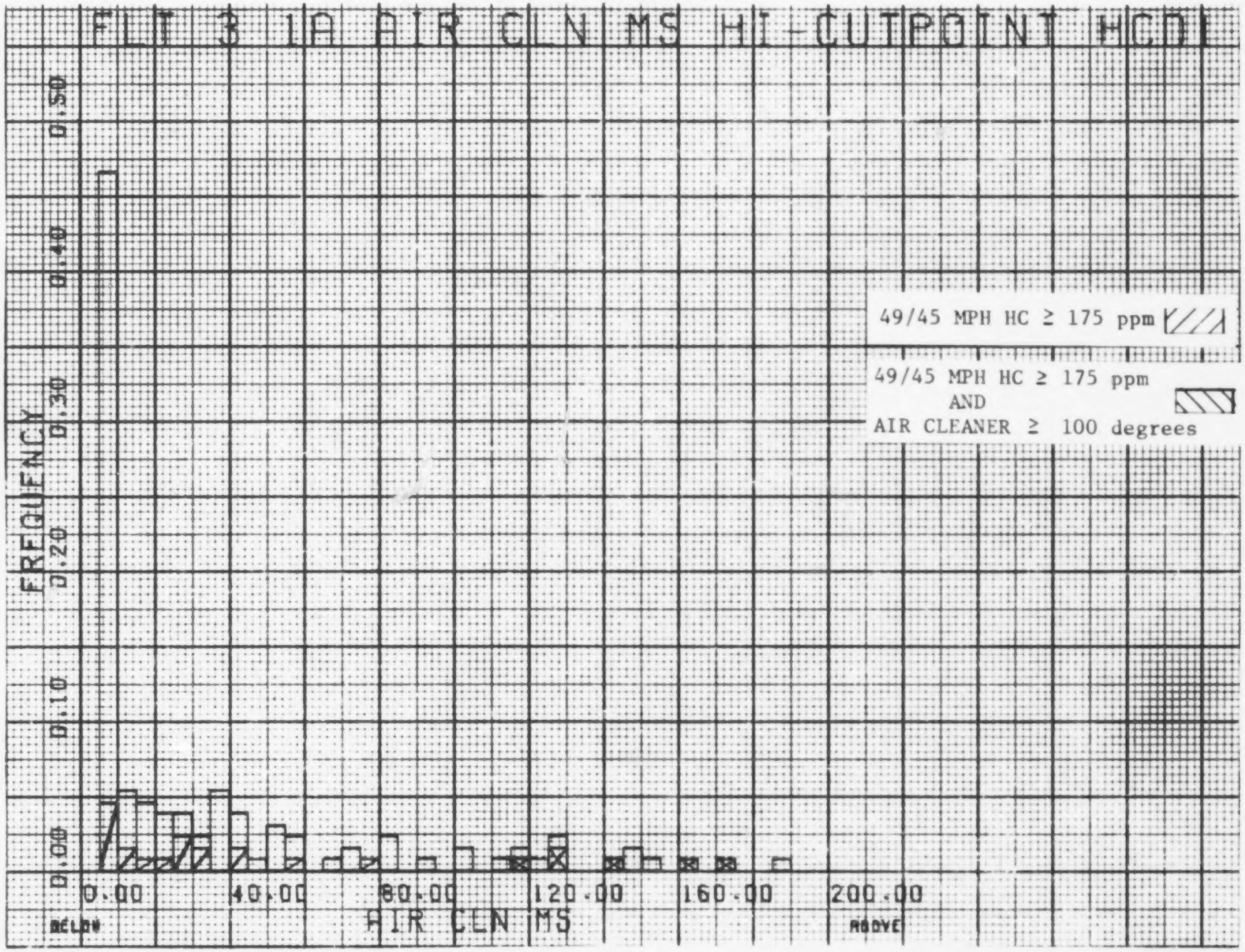


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

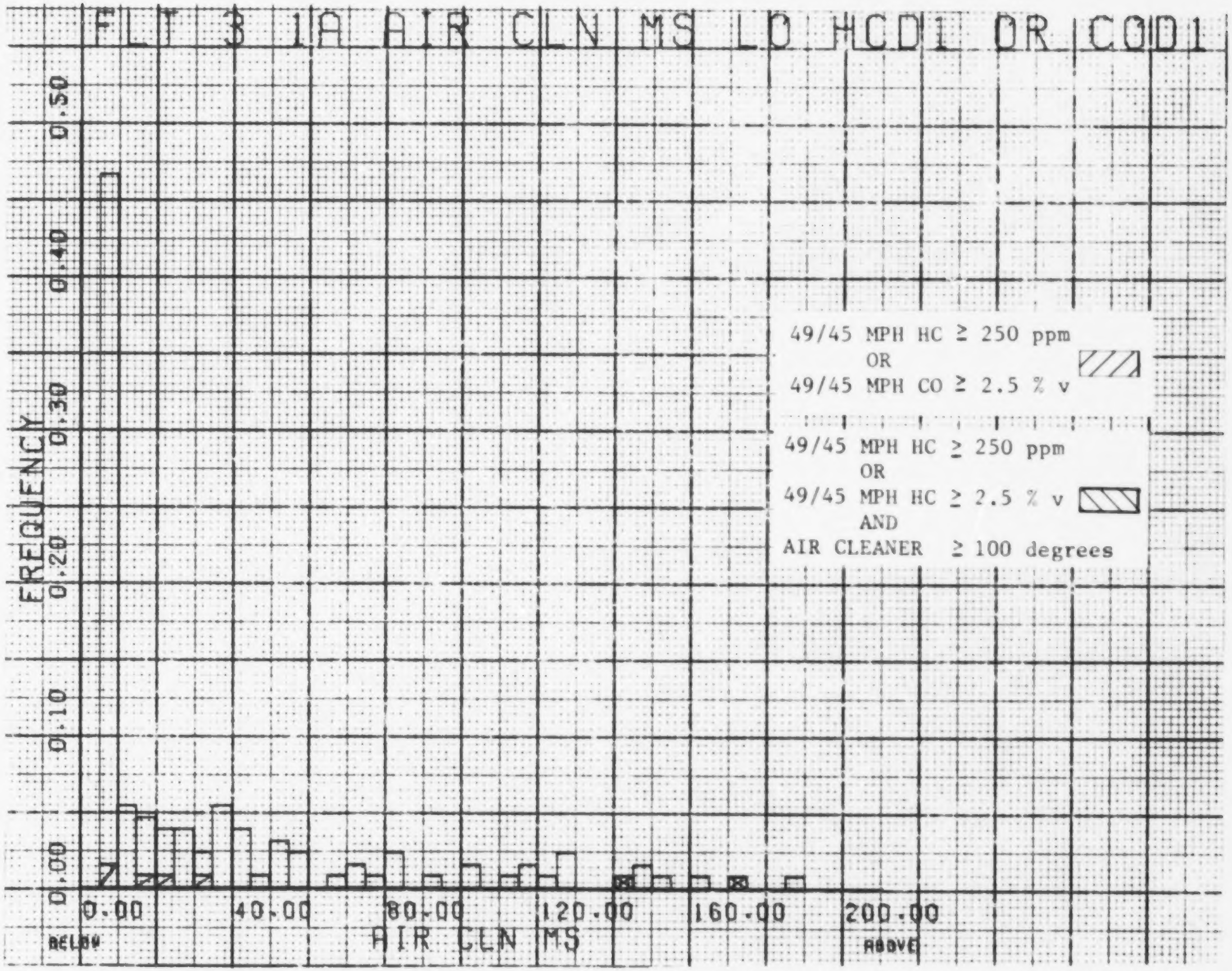


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

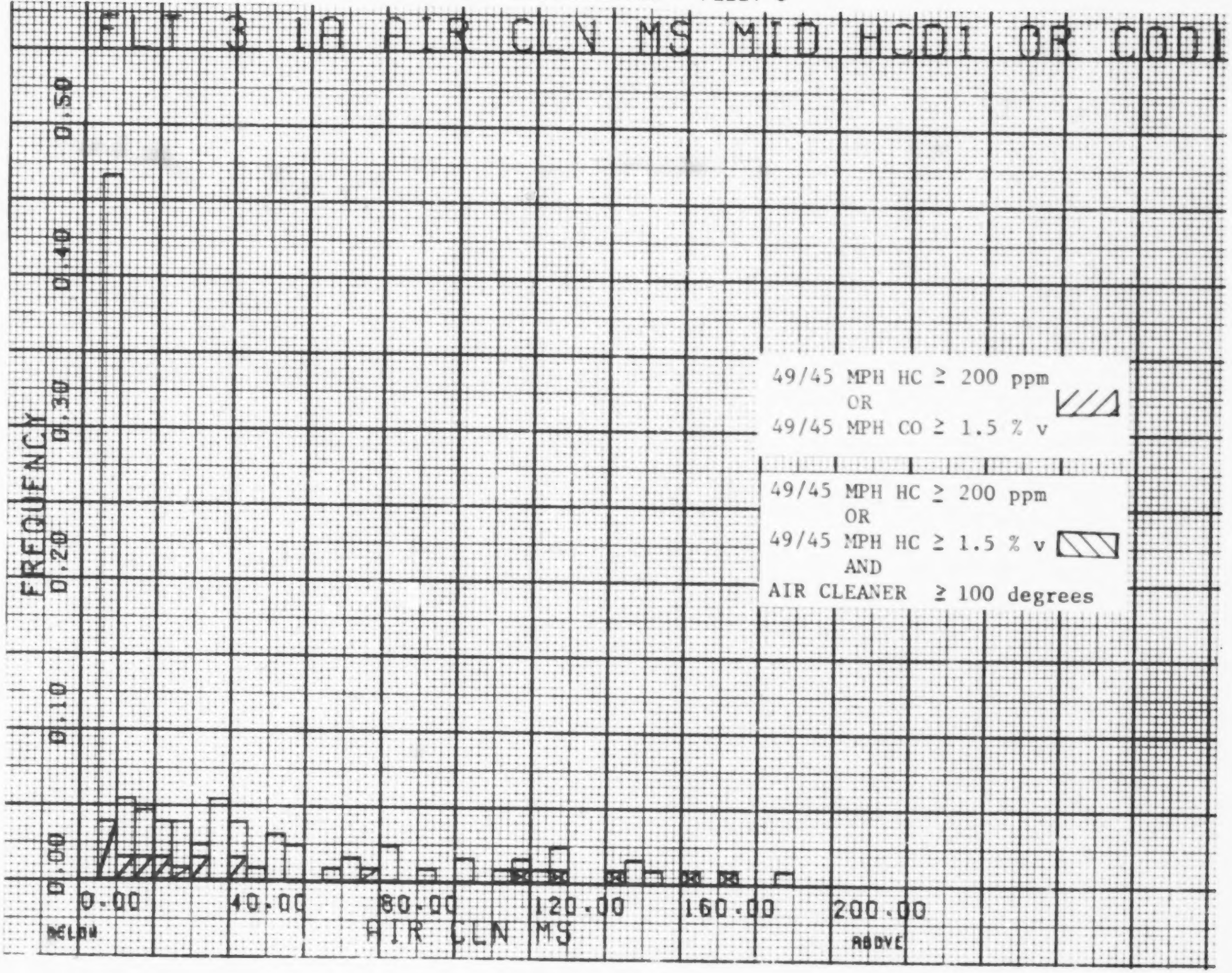


FIGURE 3

CUTPOINT DISTRIBUTION - FLEET 3

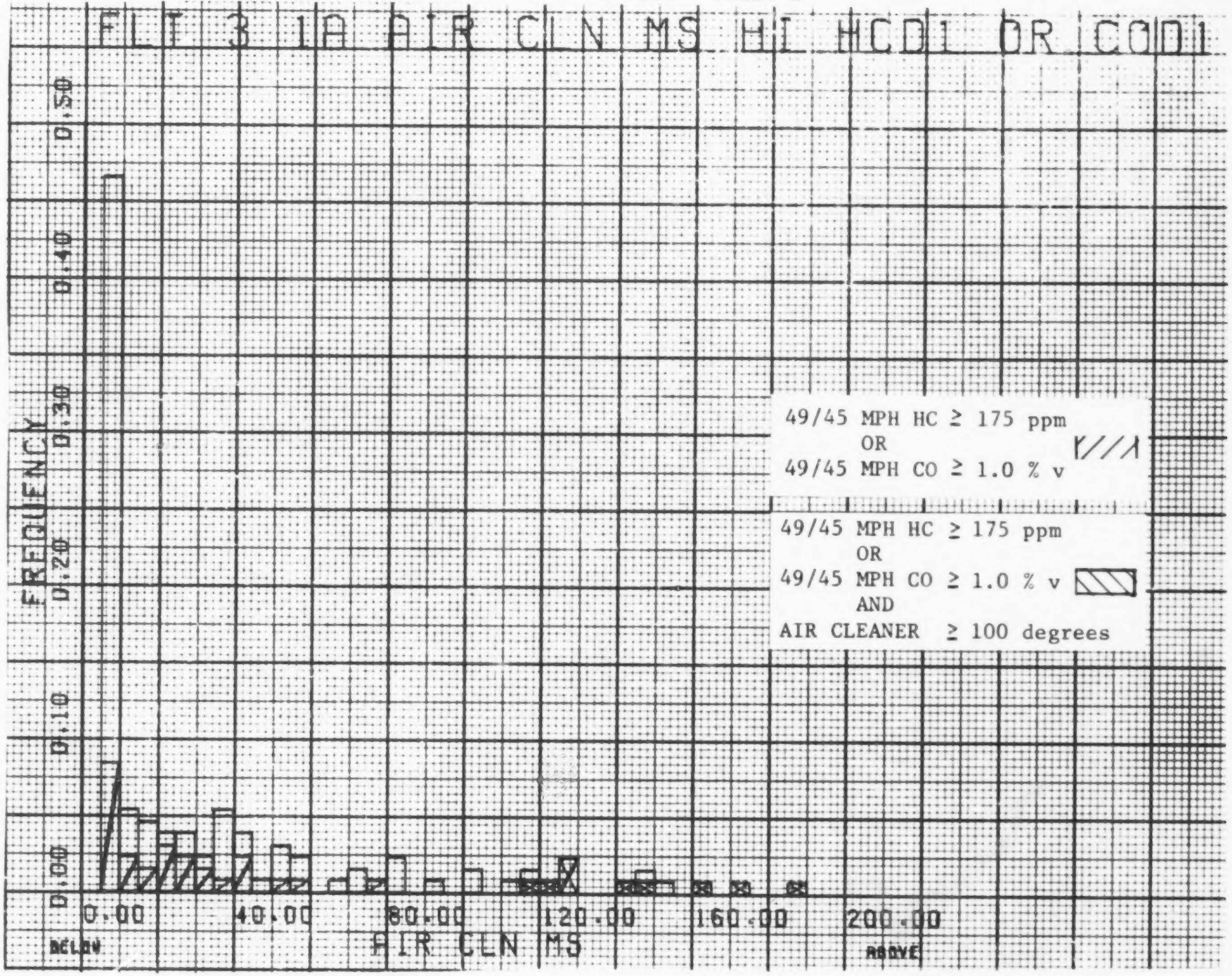


FIGURE 4

CUTPOINT DISTRIBUTION - FLEET 1

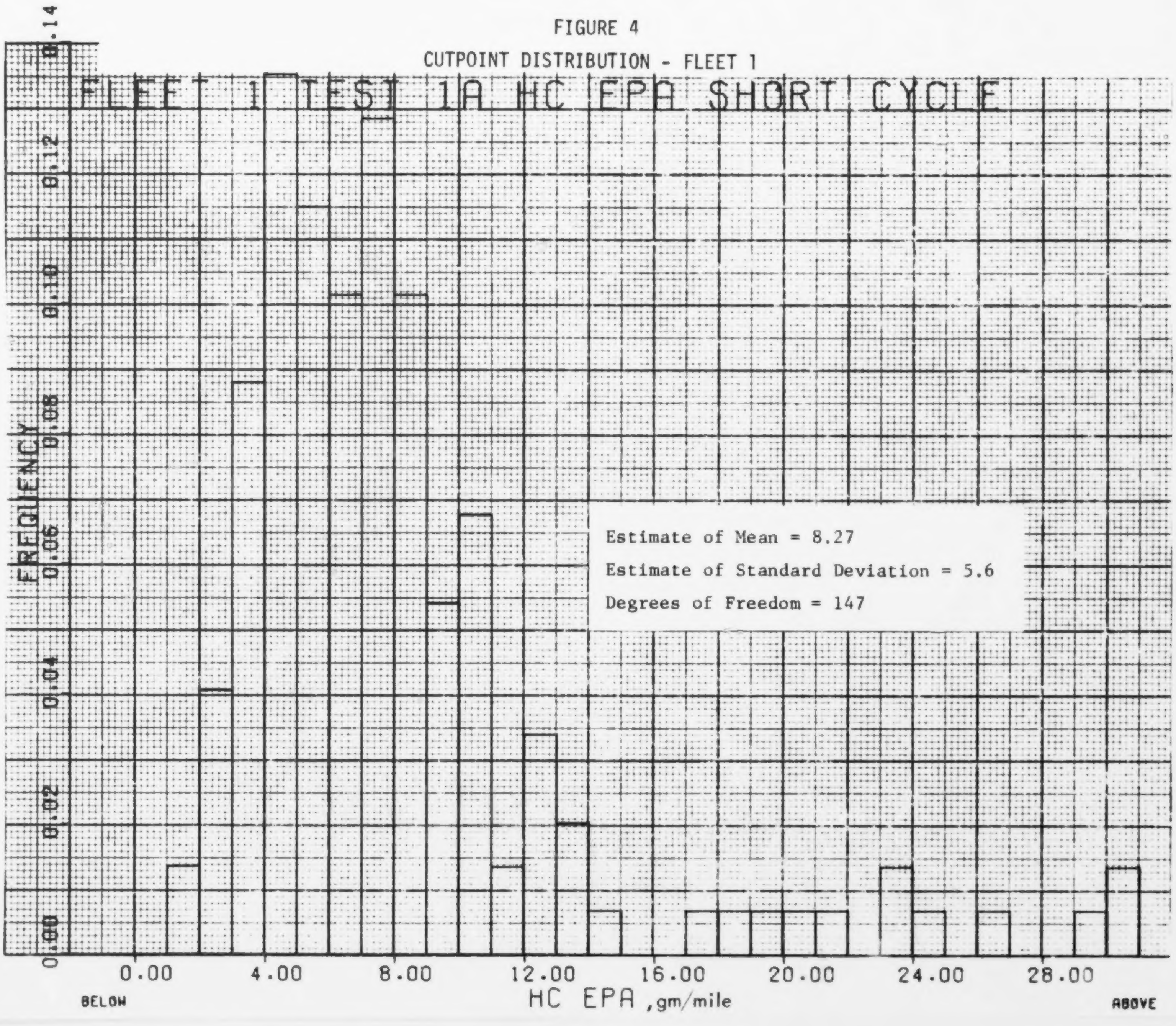
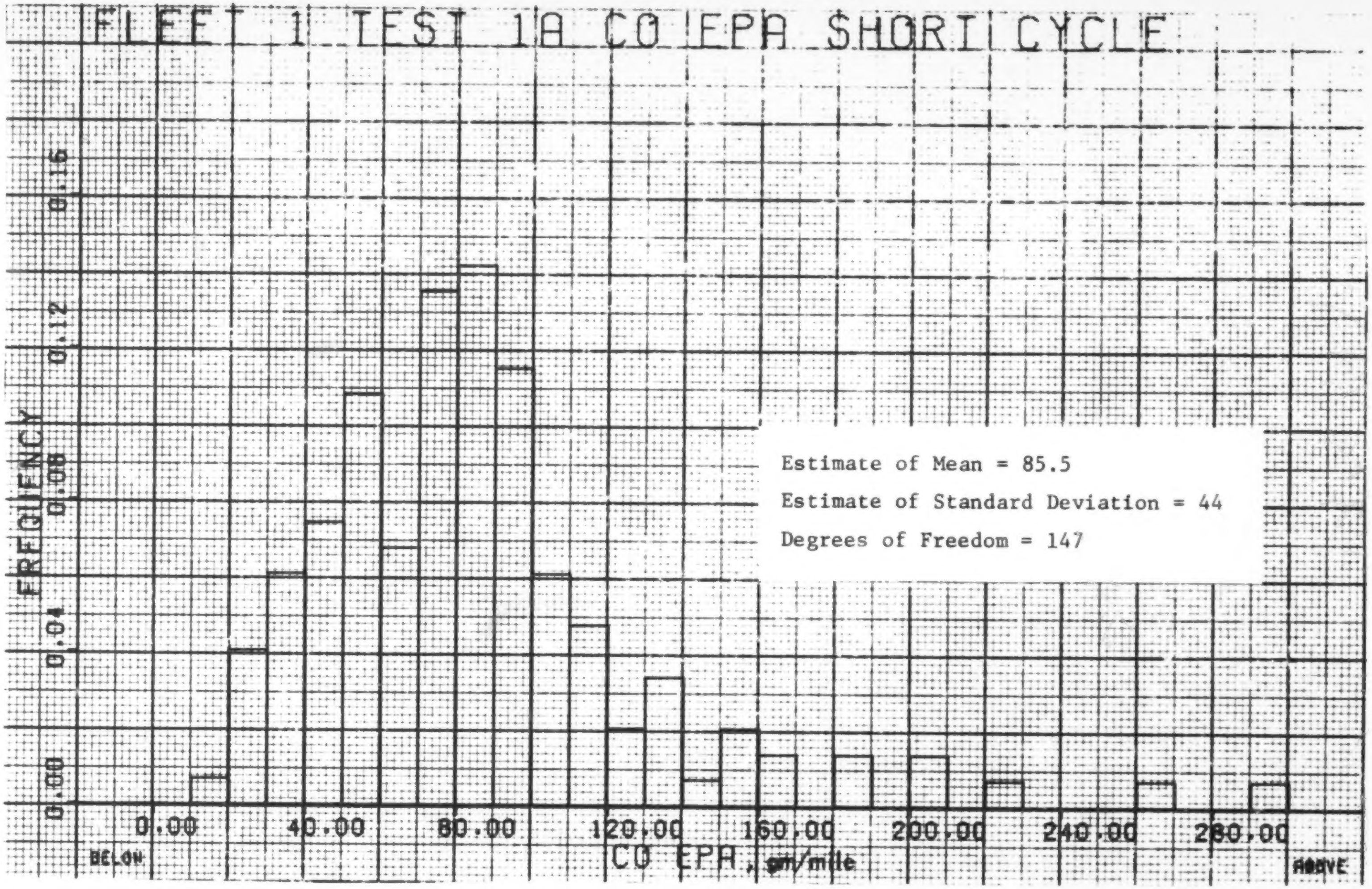


FIGURE 4

CUTPOINT DISTRIBUTION - FLEET 1



Estimate of Mean = 85.5

Estimate of Standard Deviation = 44

Degrees of Freedom = 147

FIGURE 4

CUTPOINT DISTRIBUTION - FLEET 1

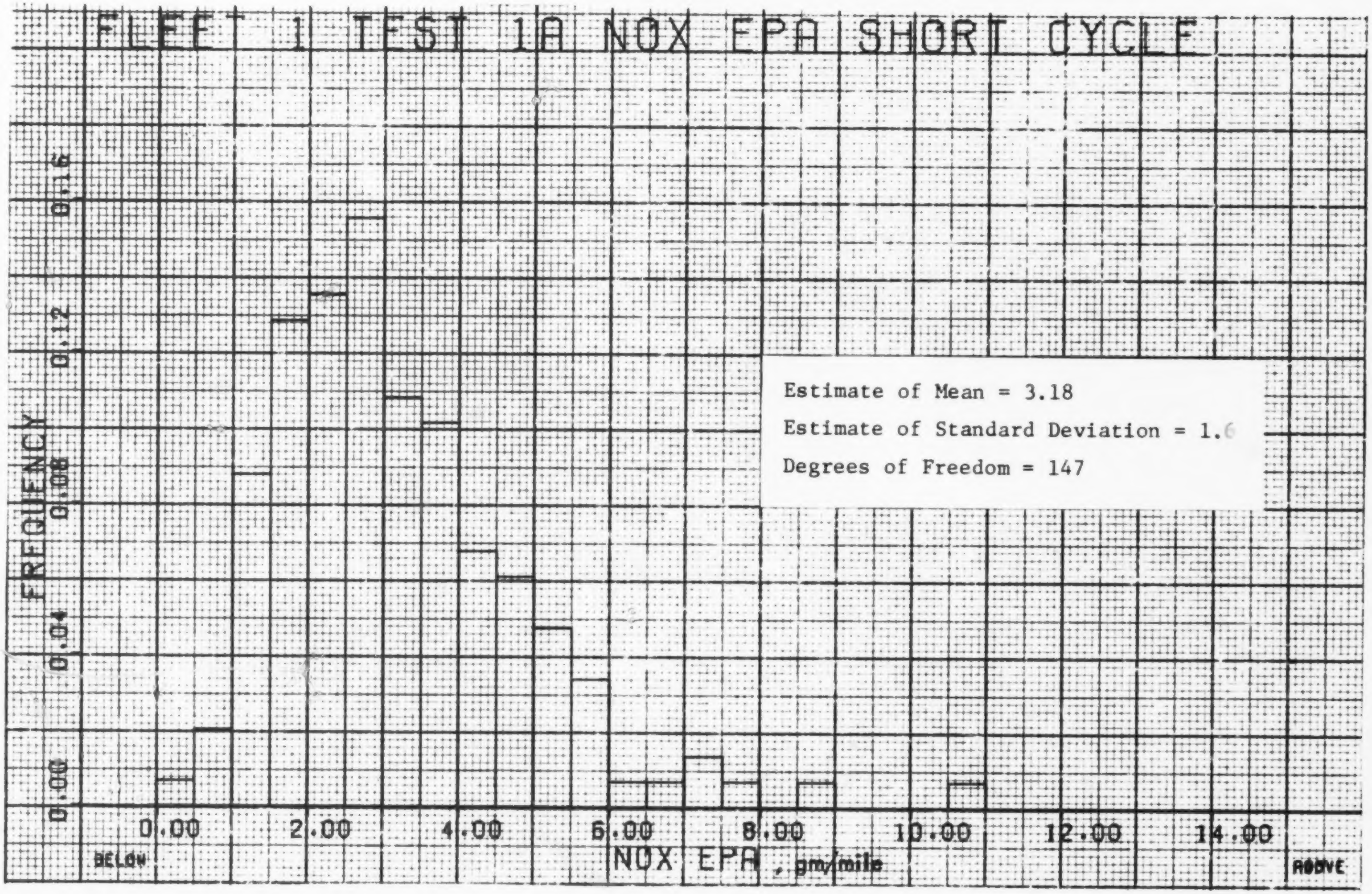
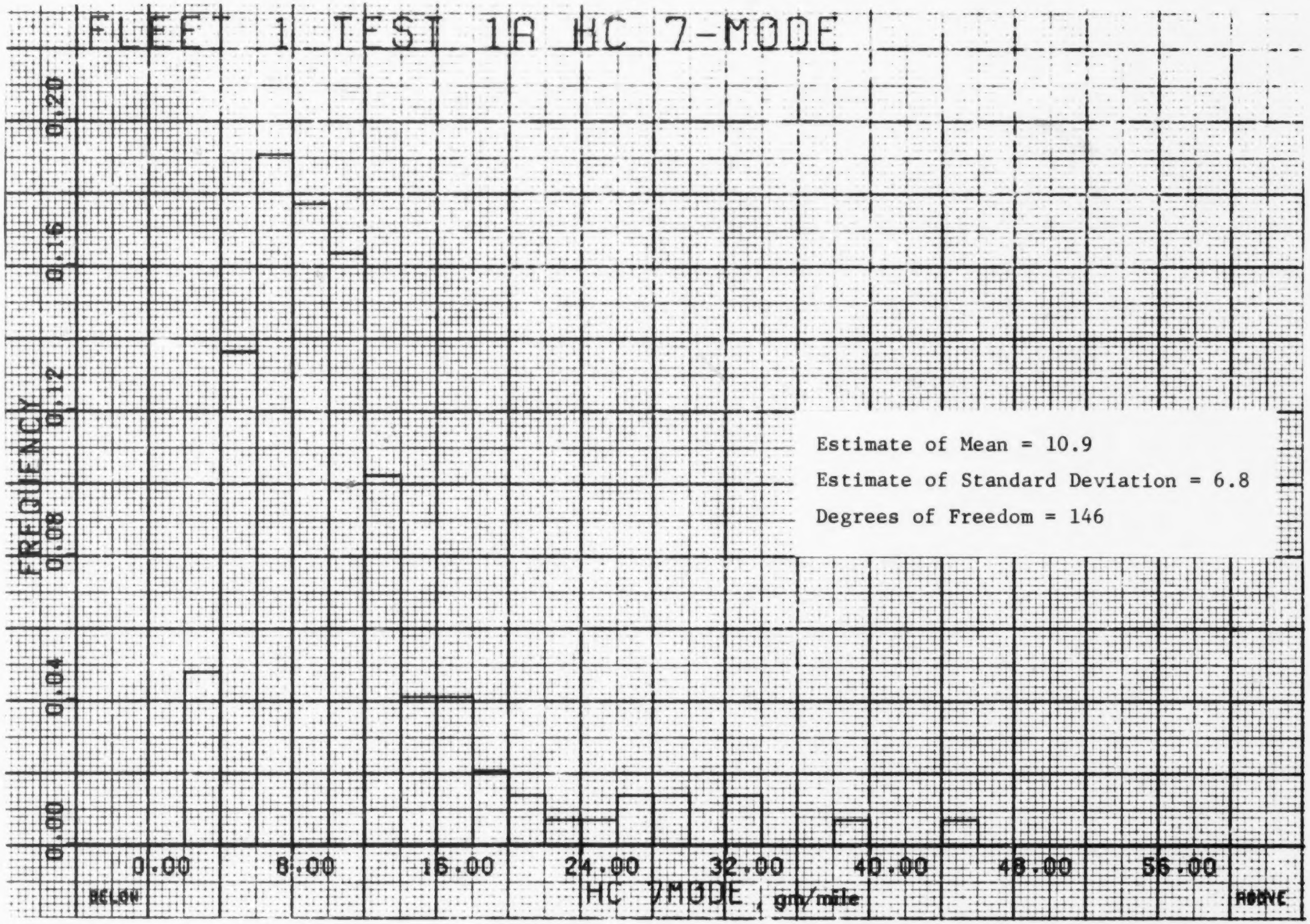


FIGURE 4

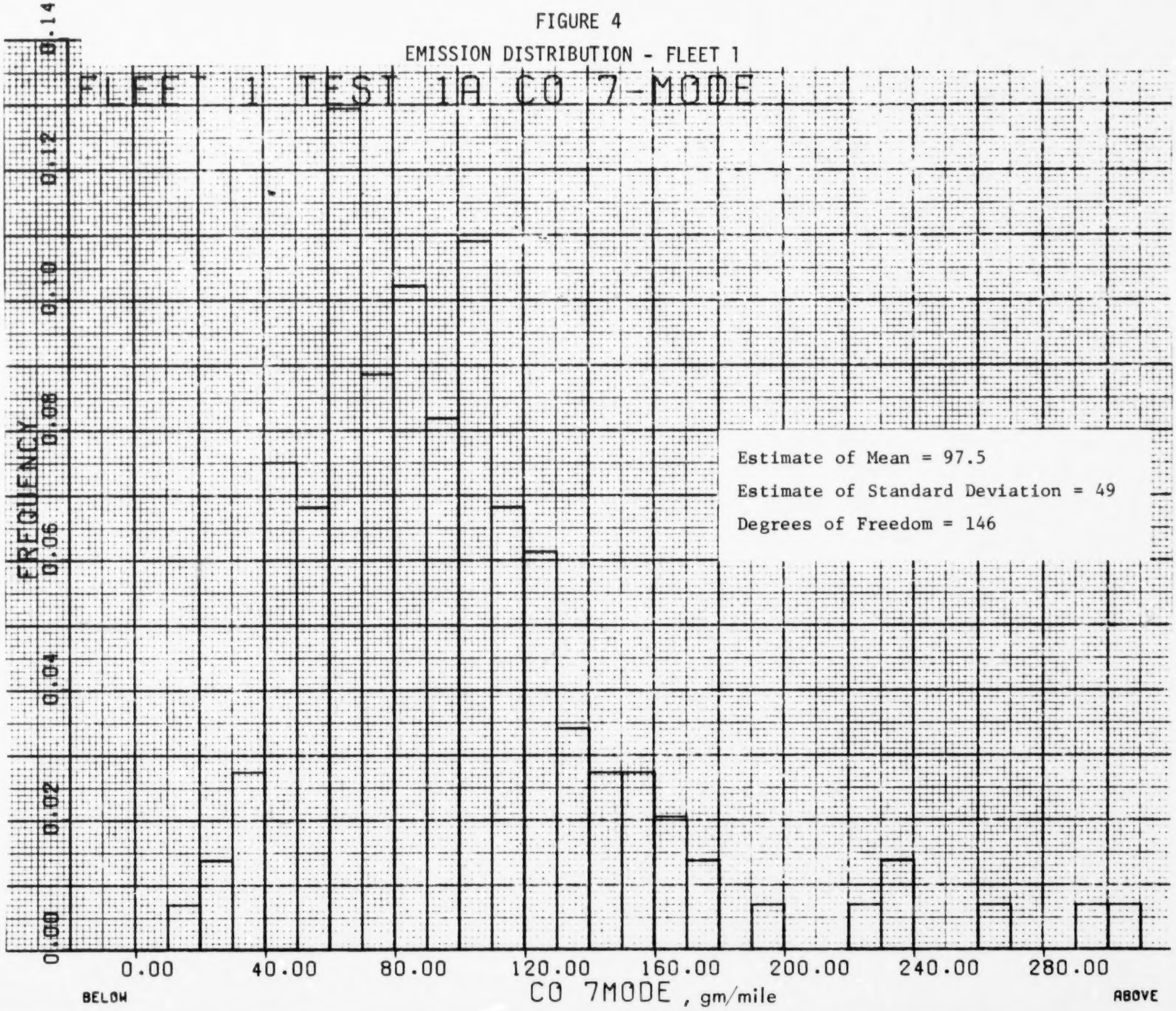
CUTPOINT DISTRIBUTION - FLEET 1



Estimate of Mean = 10.9
Estimate of Standard Deviation = 6.8
Degrees of Freedom = 146

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



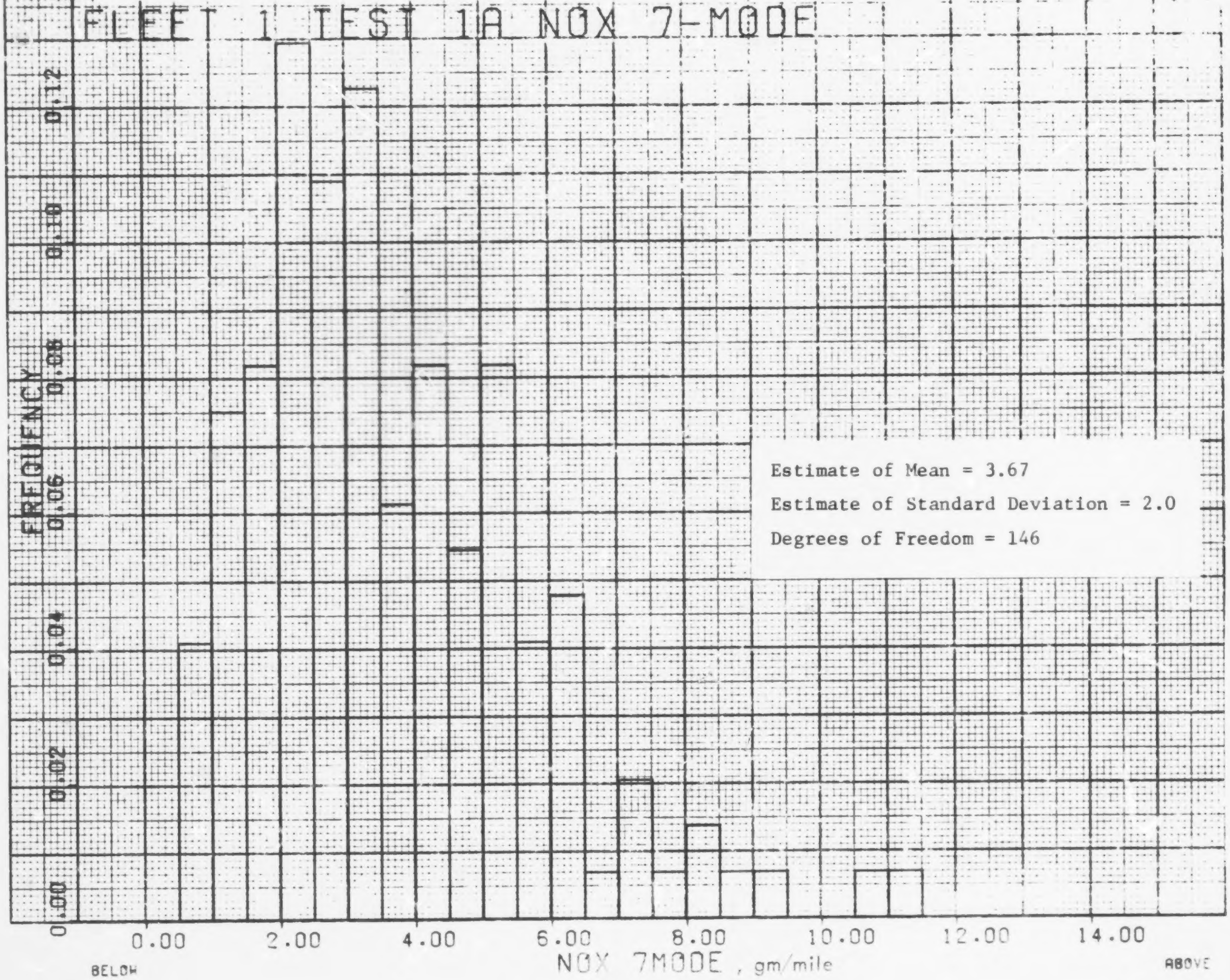
Estimate of Mean = 97.5

Estimate of Standard Deviation = 49

Degrees of Freedom = 146

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



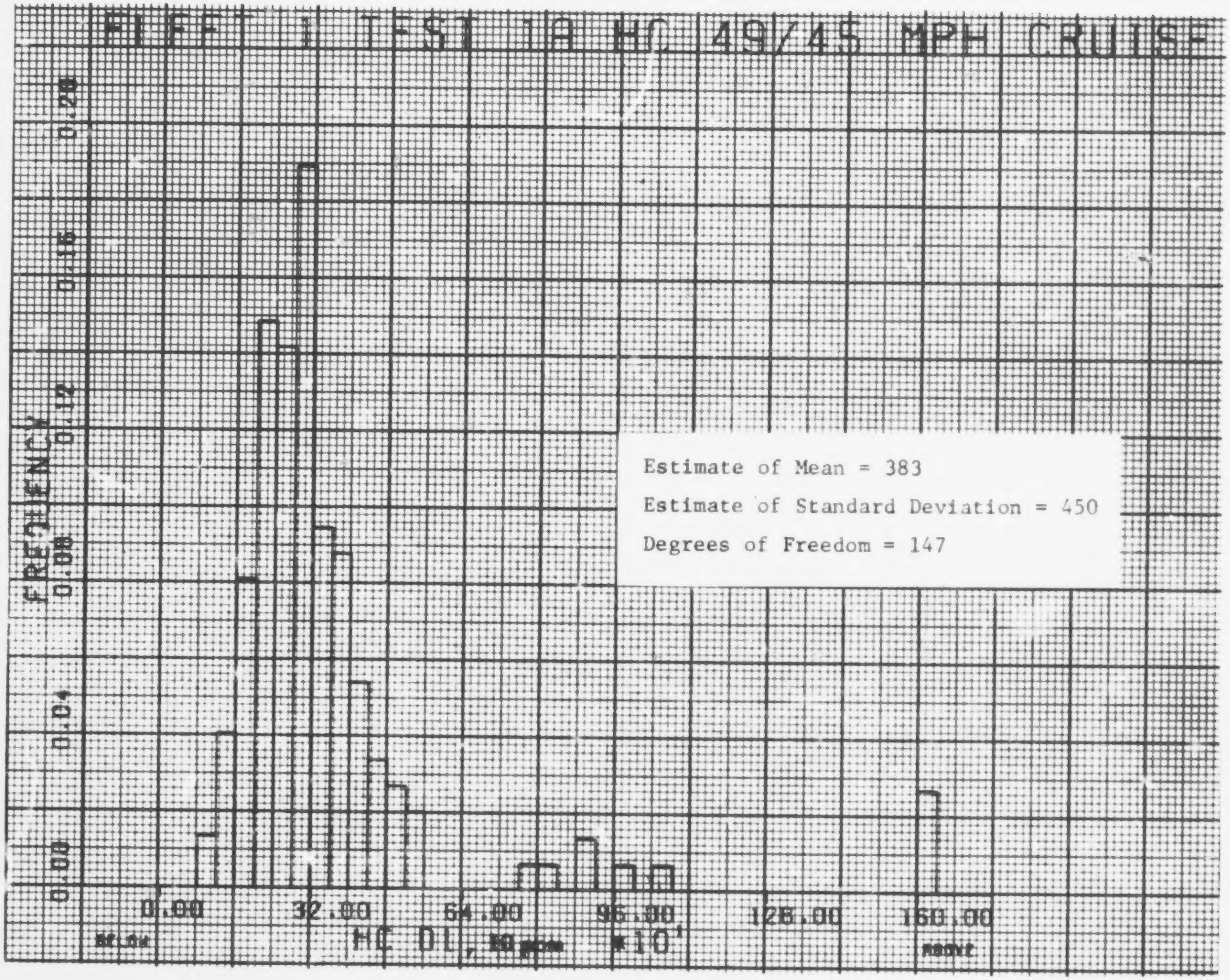
Estimate of Mean = 3.67

Estimate of Standard Deviation = 2.0

Degrees of Freedom = 146

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



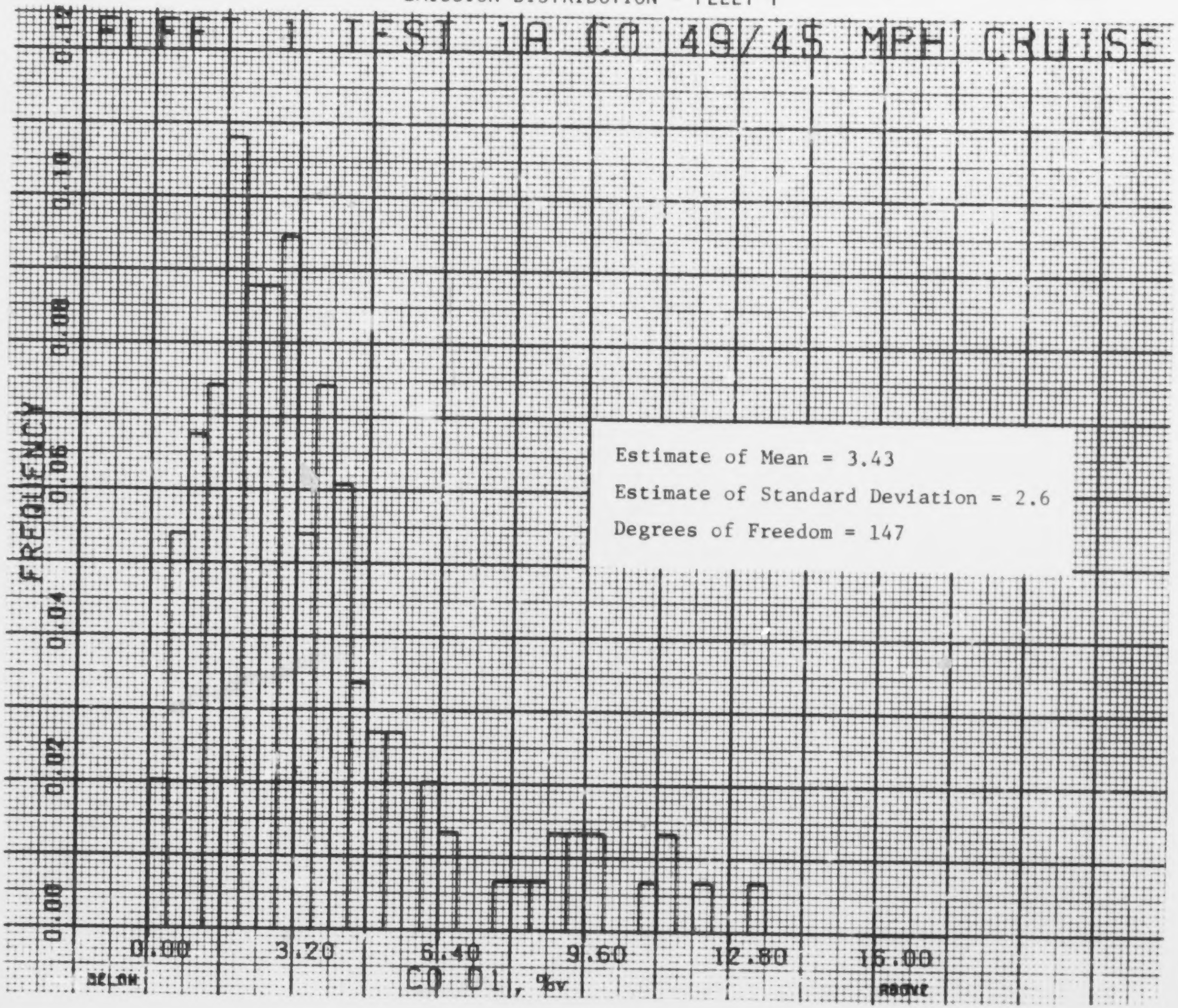
Estimate of Mean = 383

Estimate of Standard Deviation = 450

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



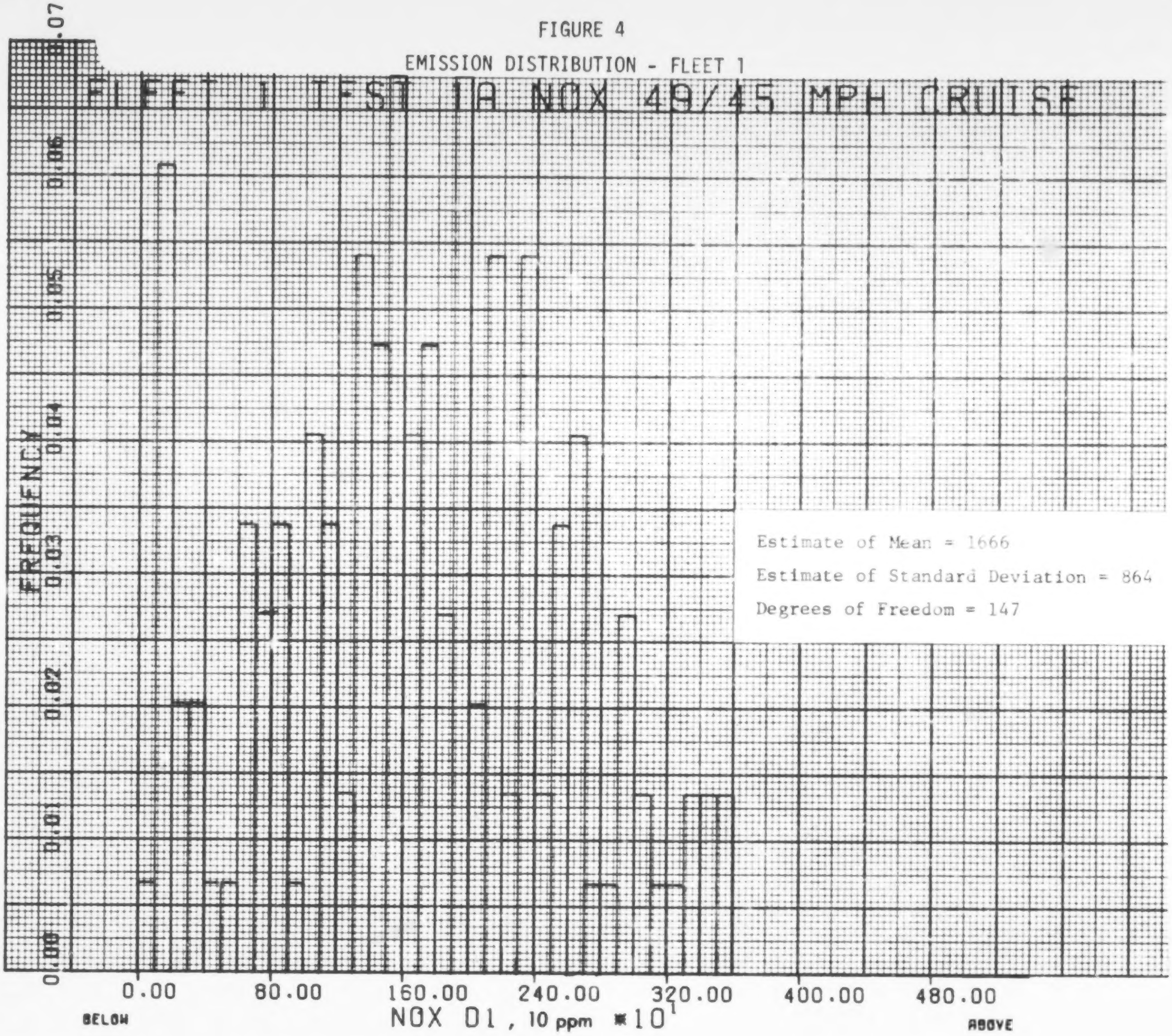
Estimate of Mean = 3.43

Estimate of Standard Deviation = 2.6

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



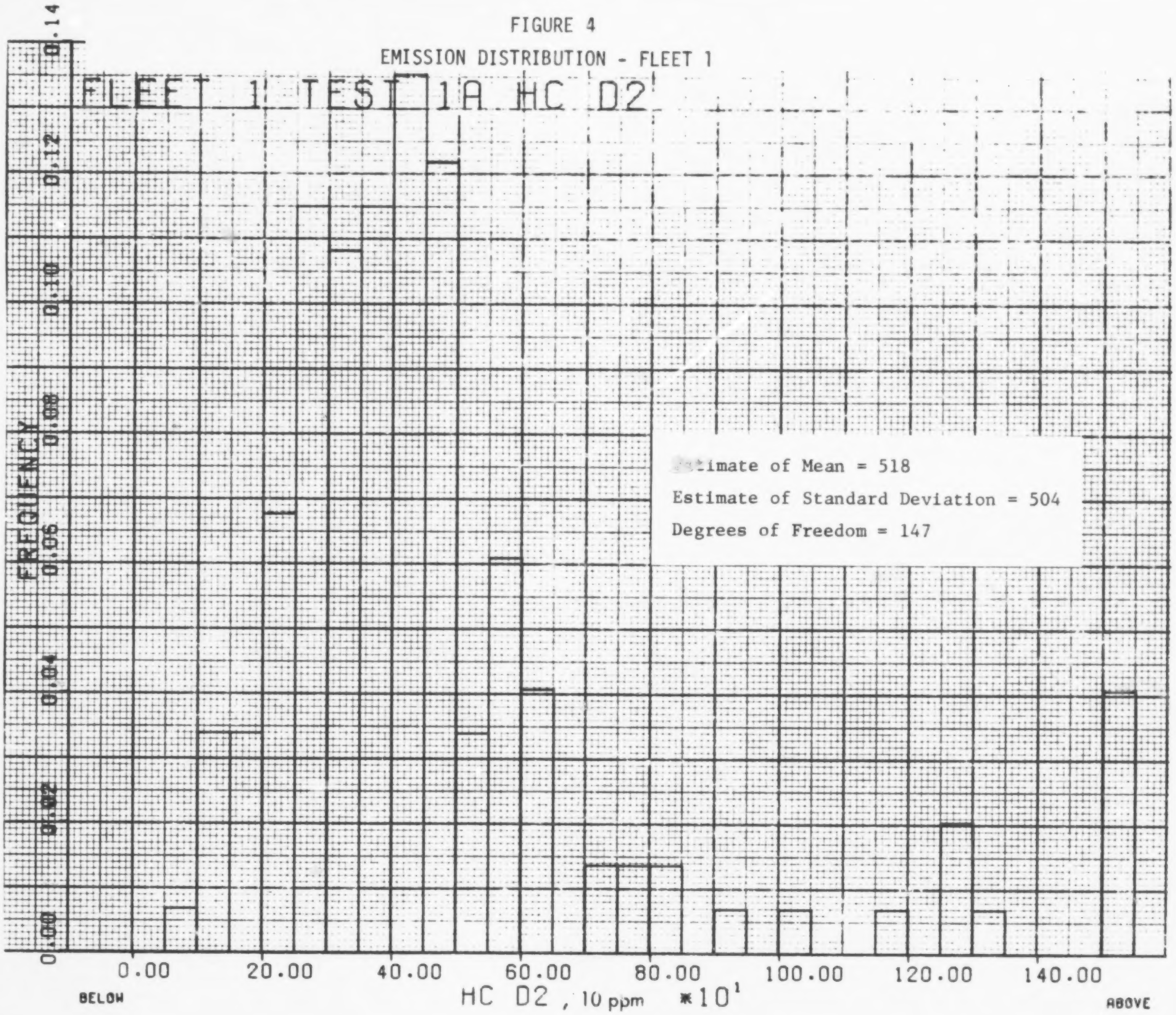
Estimate of Mean = 1666

Estimate of Standard Deviation = 864

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



Estimate of Mean = 518

Estimate of Standard Deviation = 504

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1

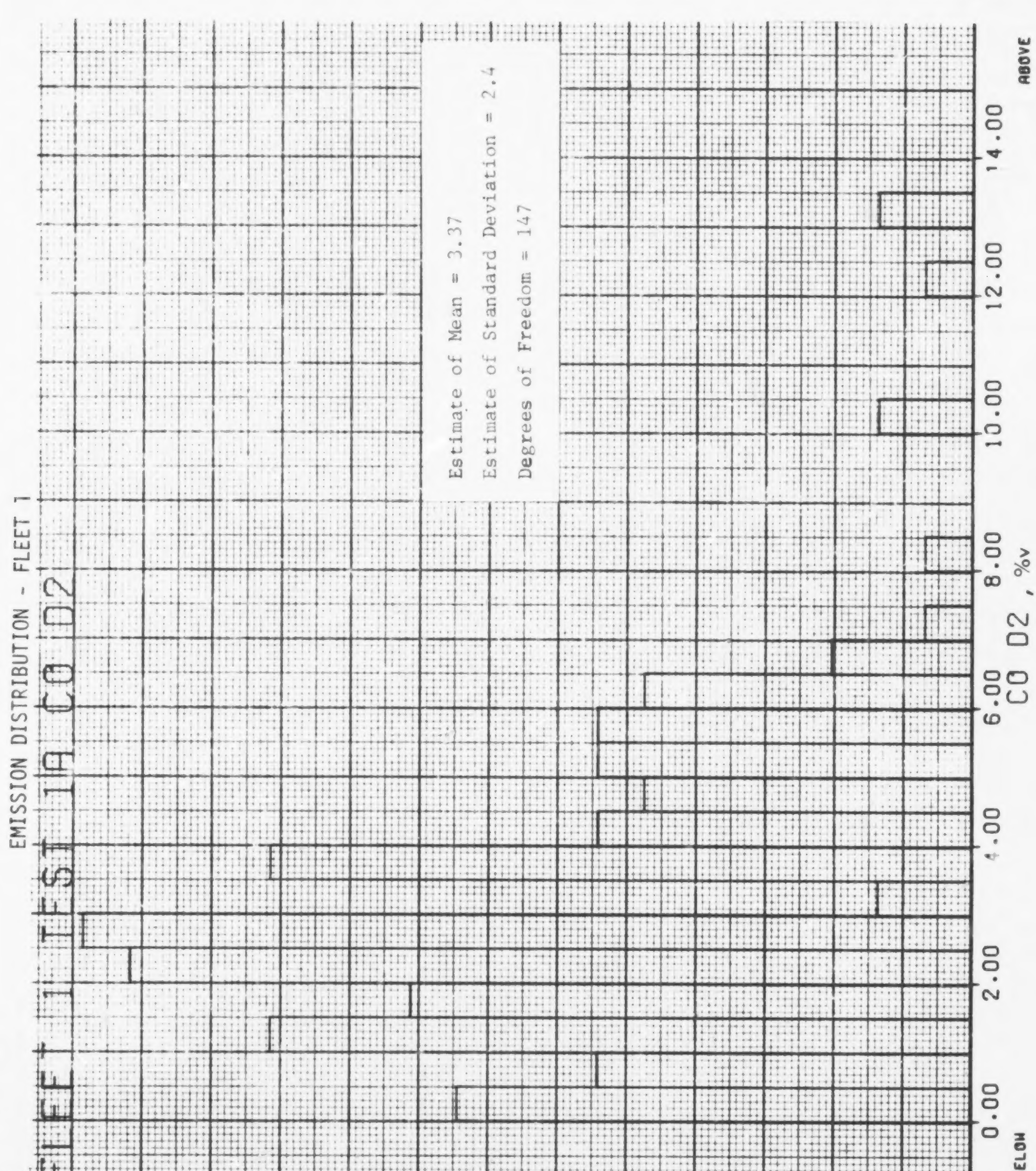
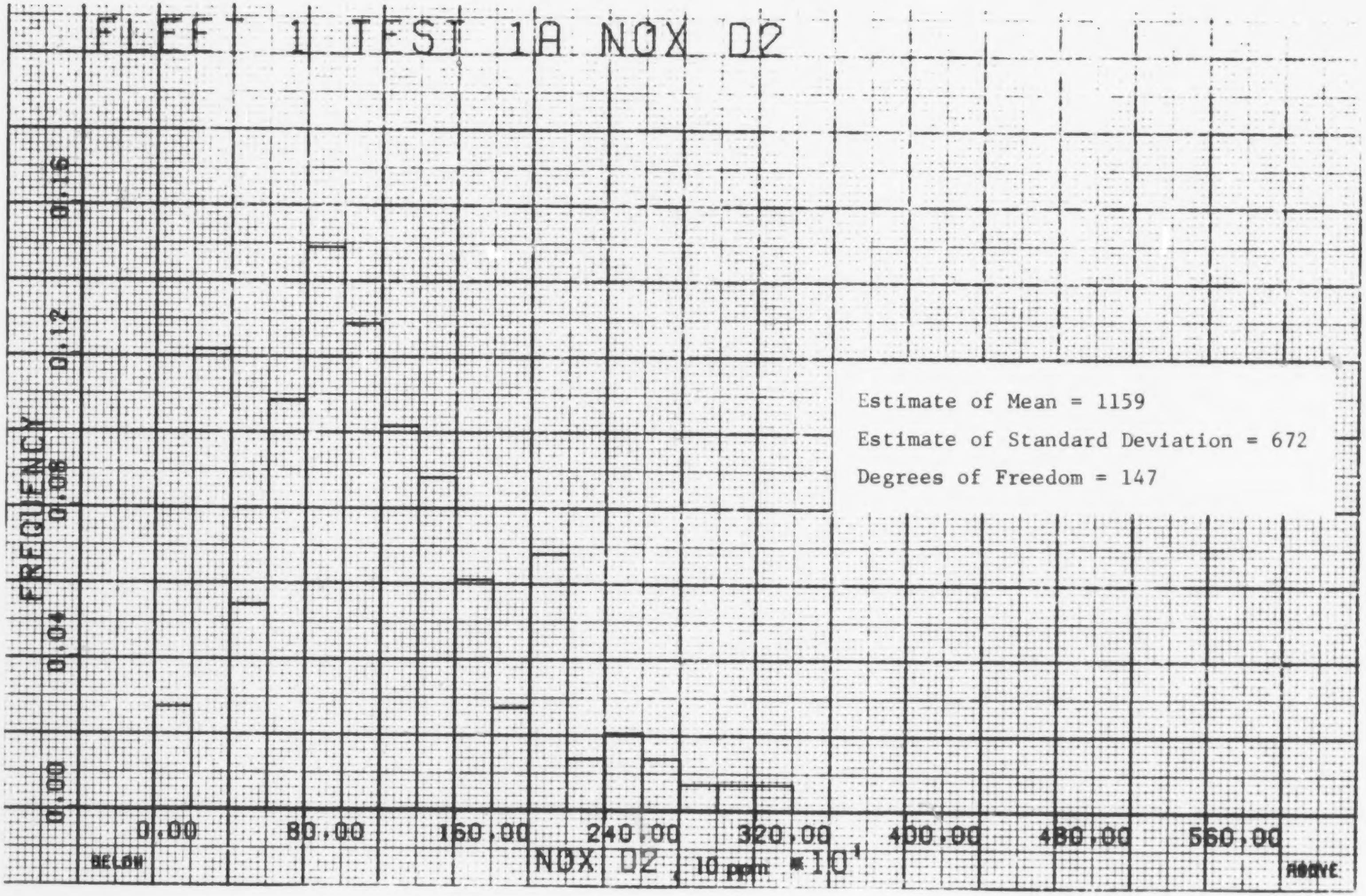


FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



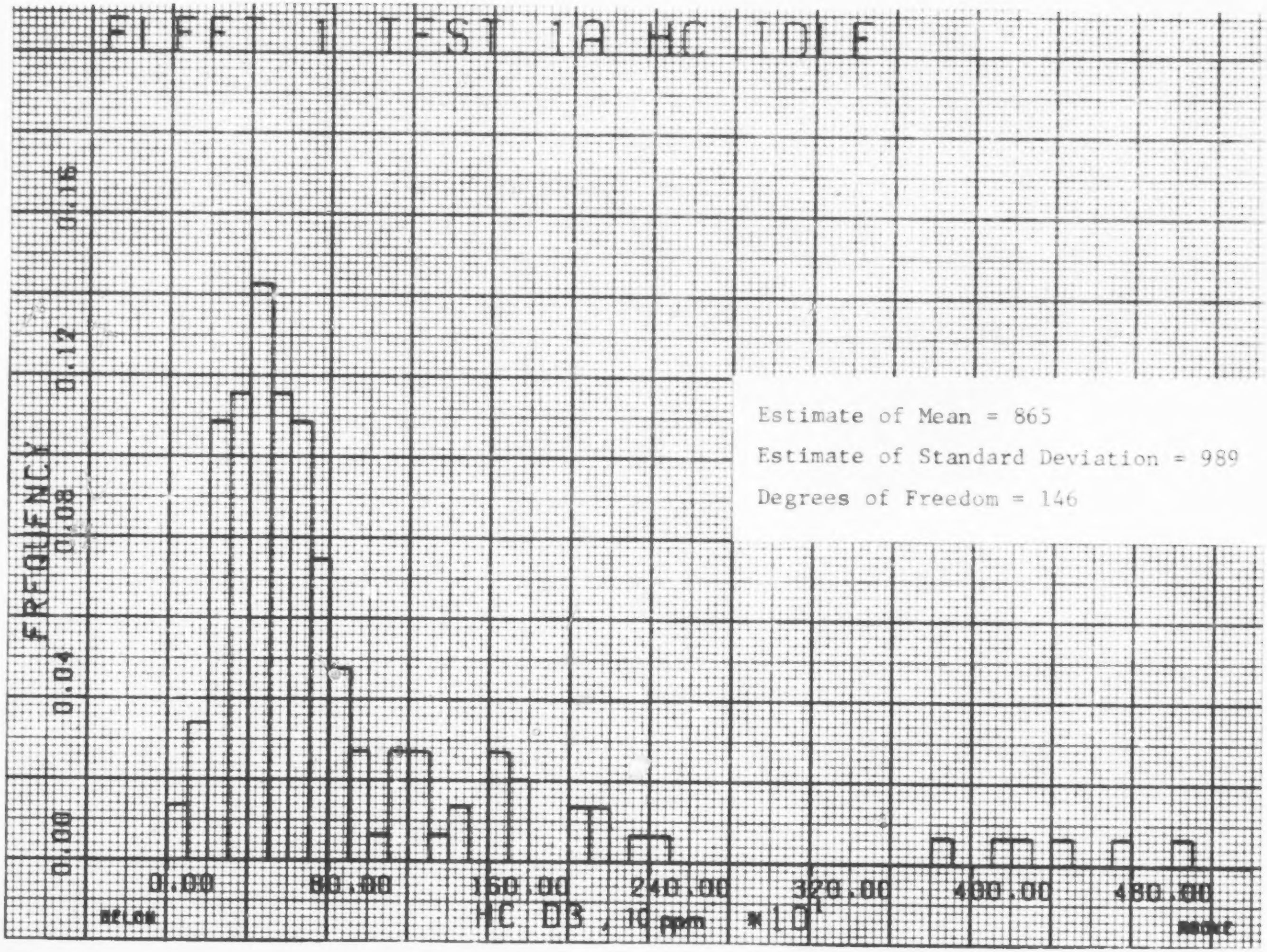
Estimate of Mean = 1159

Estimate of Standard Deviation = 672

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



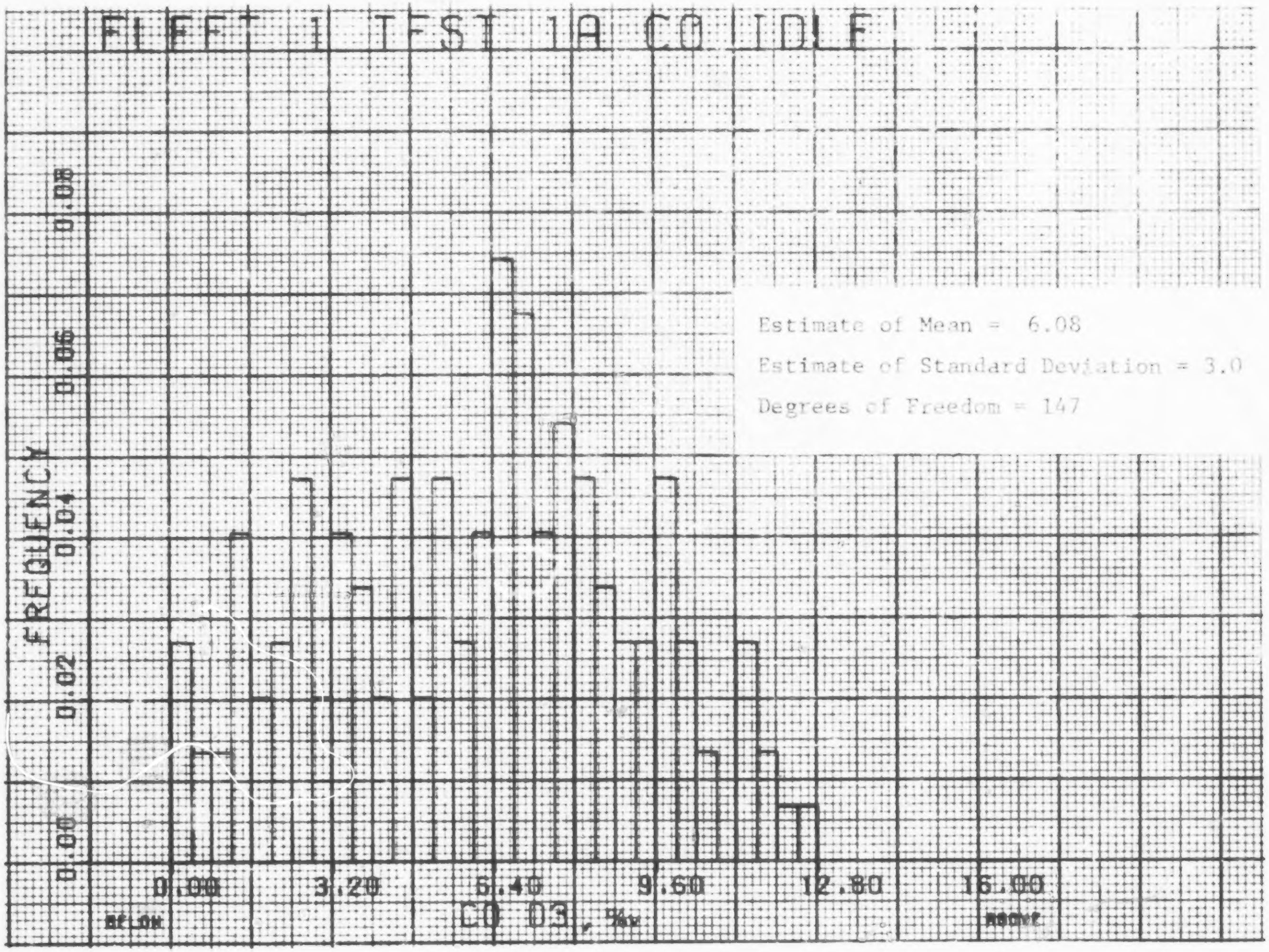
Estimate of Mean = 865

Estimate of Standard Deviation = 989

Degrees of Freedom = 146

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



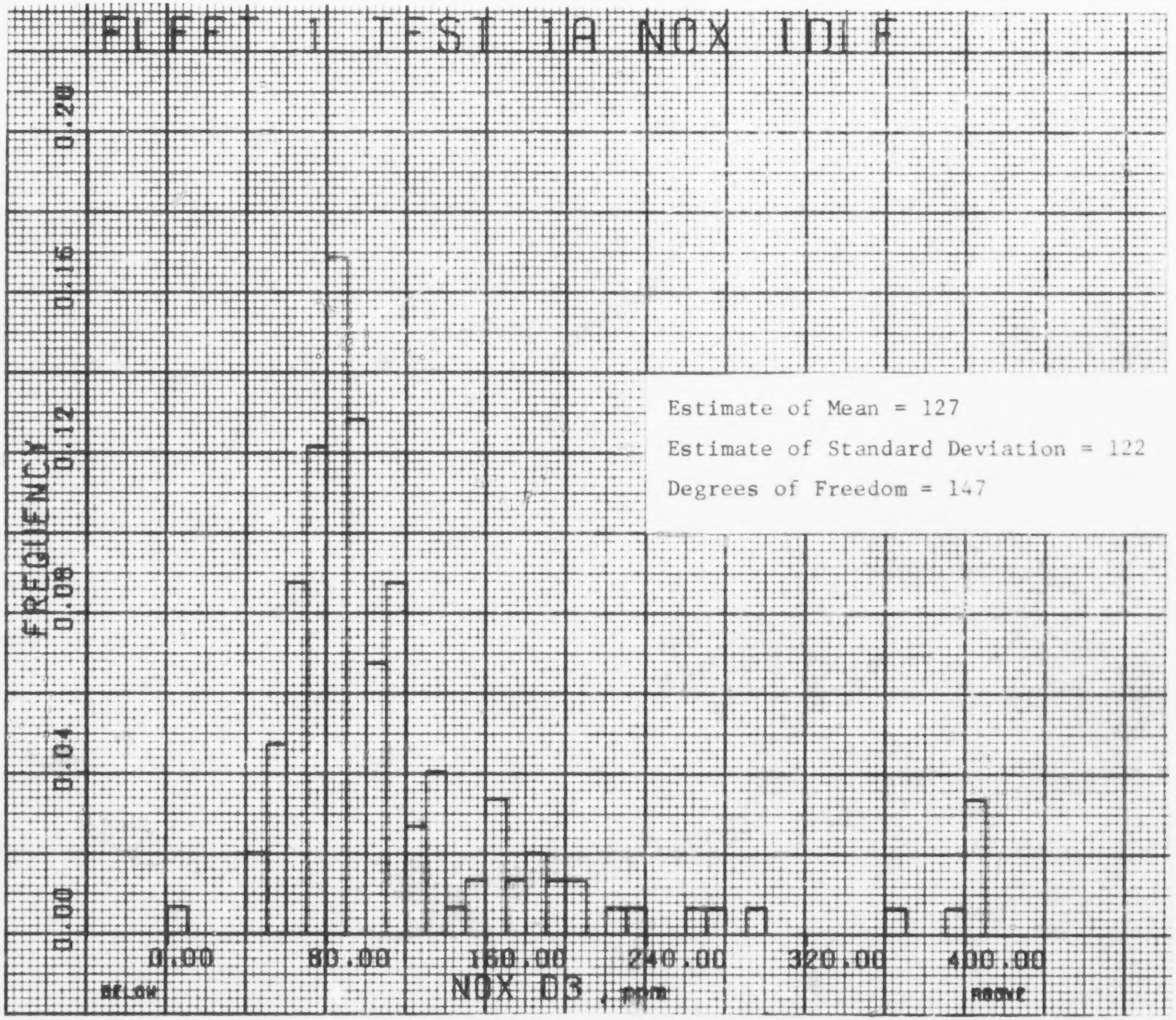
Estimate of Mean = 6.08

Estimate of Standard Deviation = 3.0

Degrees of Freedom = 147

FIGURE 4

EMISSION DISTRIBUTION - FLEET 1



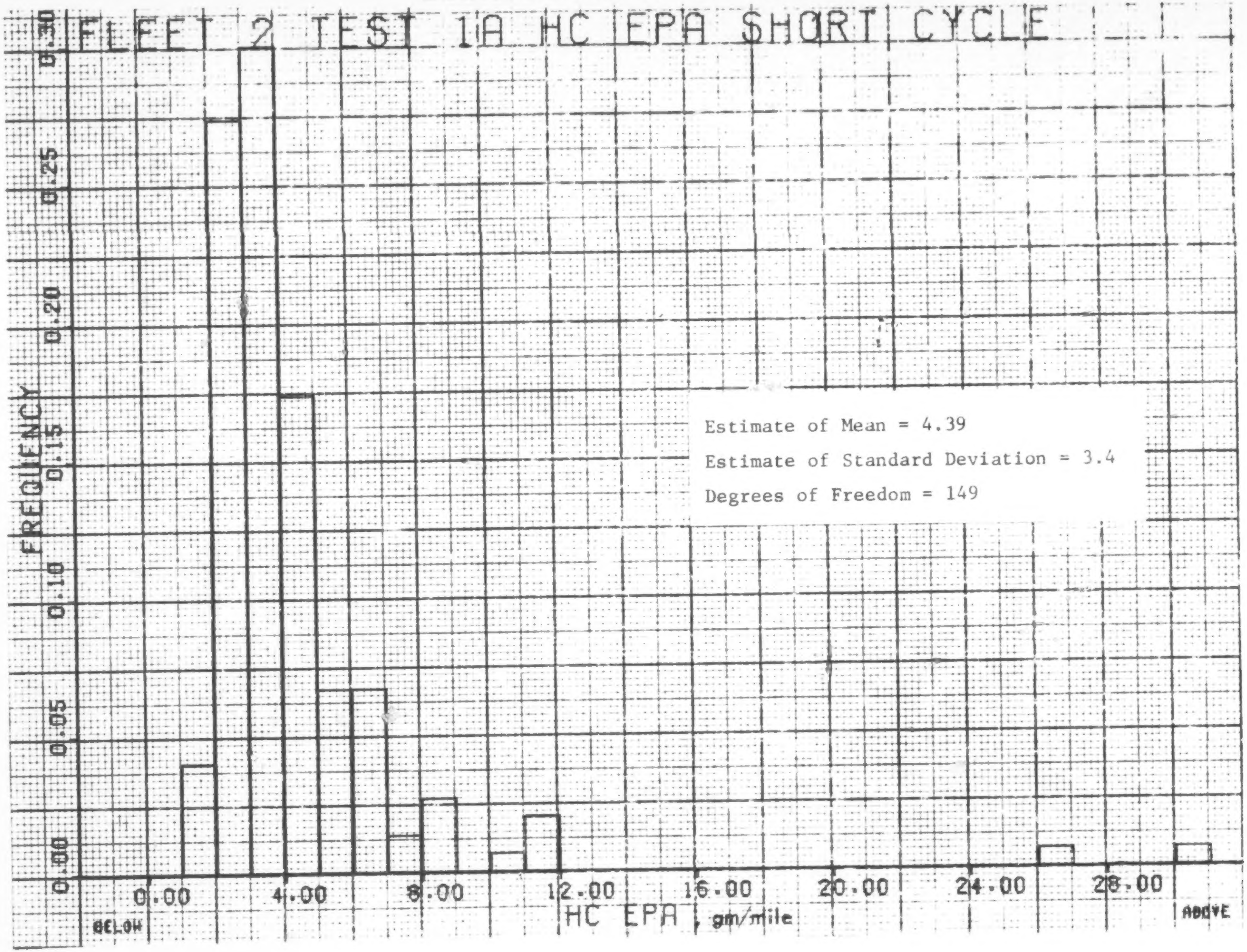
Estimate of Mean = 127

Estimate of Standard Deviation = 122

Degrees of Freedom = 147

FIGURE 5

EMISSION DISTRIBUTION - FLEET 2



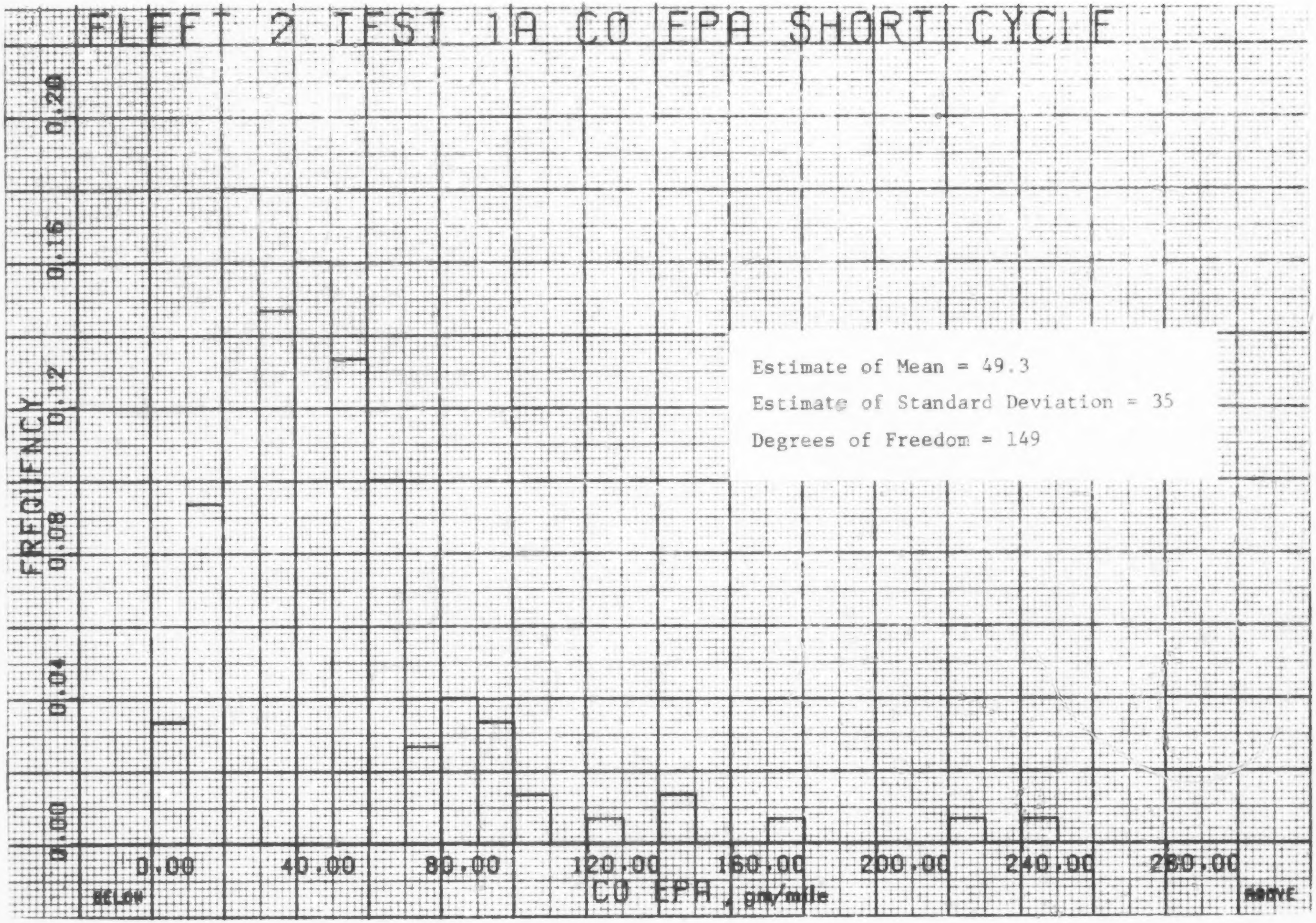
Estimate of Mean = 4.39

Estimate of Standard Deviation = 3.4

Degrees of Freedom = 149

FIGURE 5

EMISSION DISTRIBUTION - FLEET 2



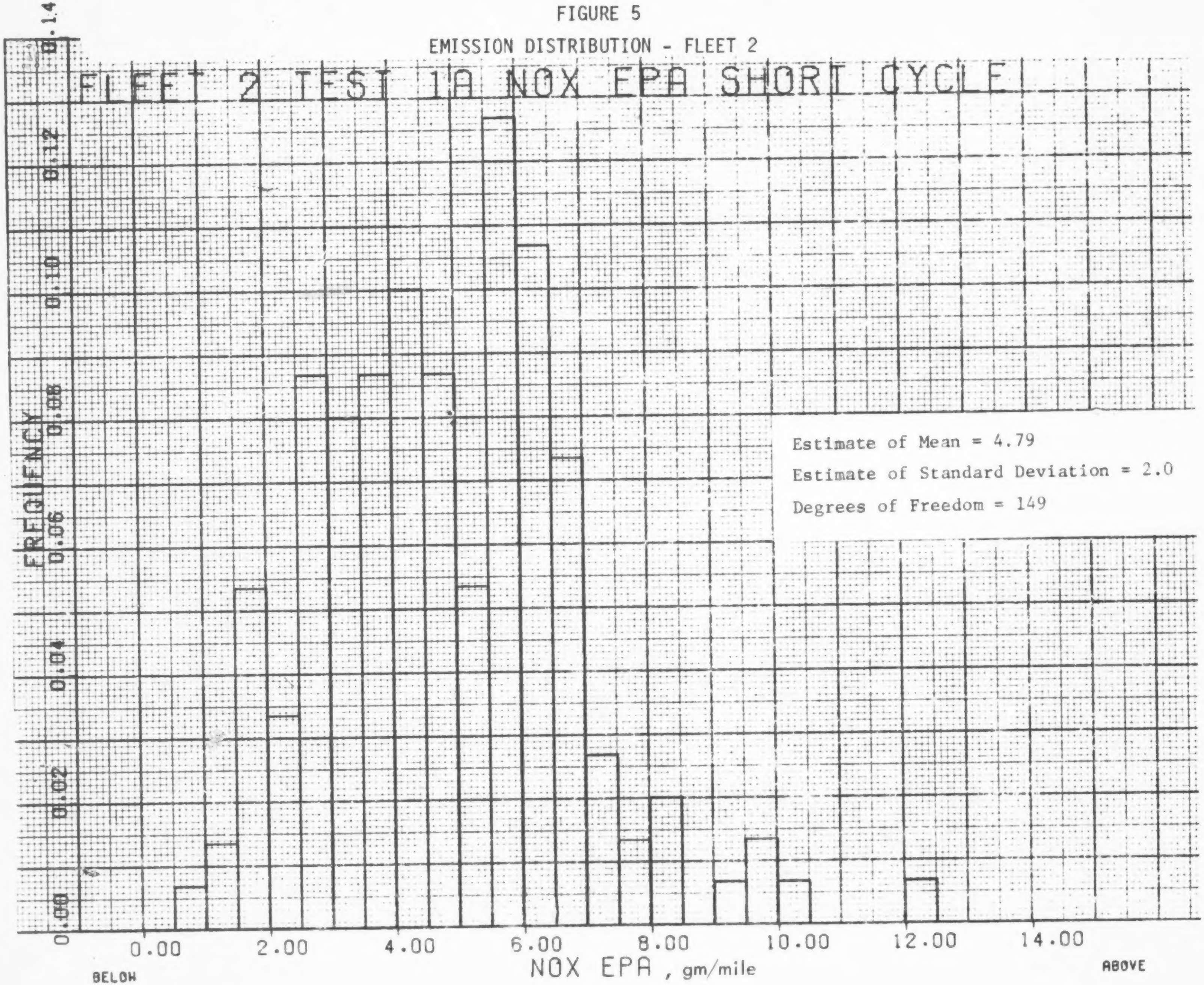
Estimate of Mean = 49.3

Estimate of Standard Deviation = 35

Degrees of Freedom = 149

FIGURE 5

EMISSION DISTRIBUTION - FLEET 2



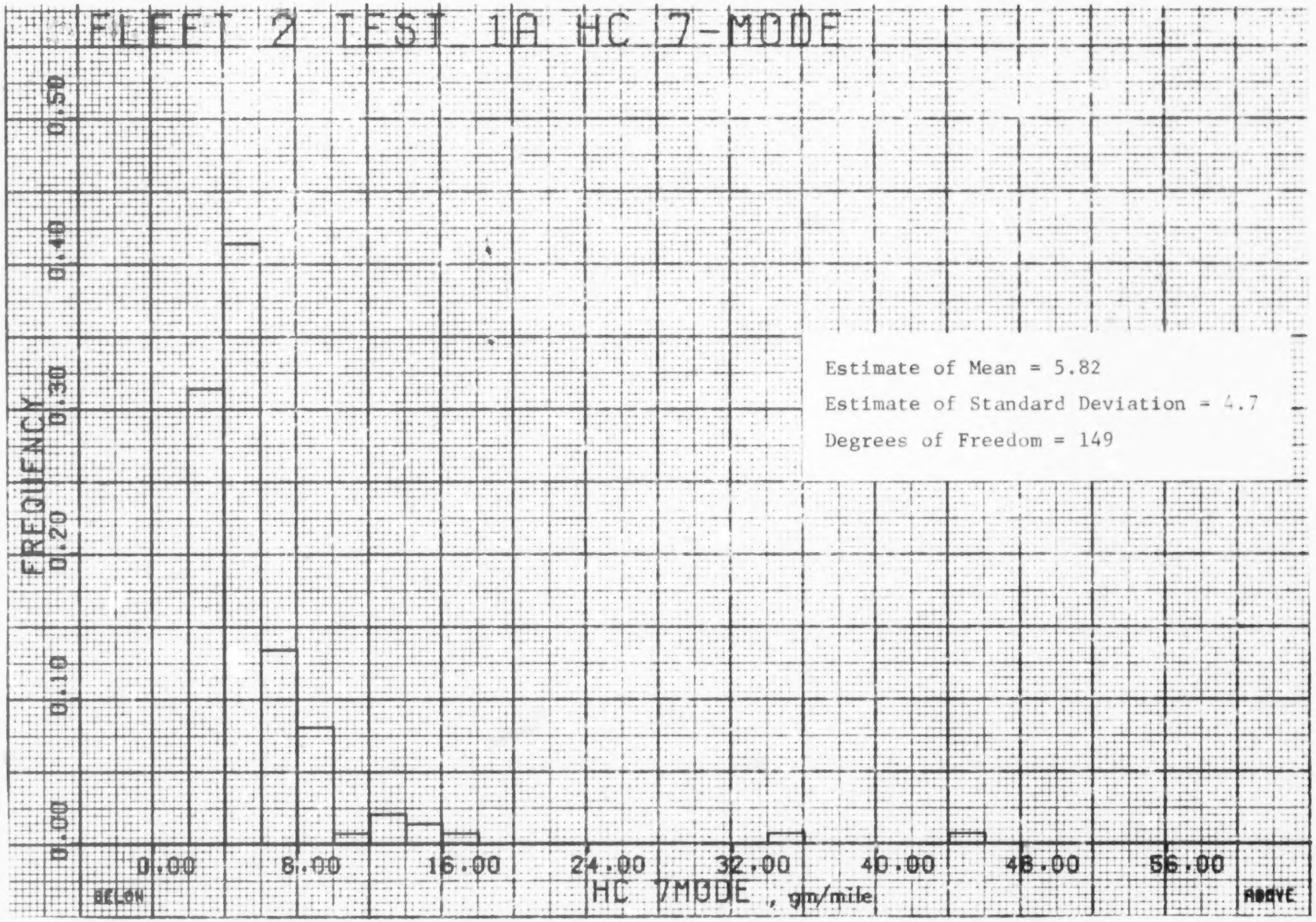
Estimate of Mean = 4.79

Estimate of Standard Deviation = 2.0

Degrees of Freedom = 149

FIGURE 5

EMISSION DISTRIBUTION - FLEET 2



Estimate of Mean = 5.82

Estimate of Standard Deviation = 4.7

Degrees of Freedom = 149

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
133.00	1.1000	3.0000	9.0400	98.090	6.8500	5.5200	7.8100	80.010	4.5100	4.0200	10.450	92.290	5.3600	4.5600
133.00	1.2000	3.0000	8.9500	79.920	6.2400	5.2100	7.2600	44.890	5.2700	4.8500	-0.	-0.	-0.	-0.
134.00	1.1000	3.0000	6.5400	81.590	3.7500	3.0800	5.8800	81.370	2.0800	2.3300	7.0900	85.690	2.8700	2.8700
134.00	1.2000	3.0000	6.9800	67.310	4.1700	3.8200	5.1300	48.830	3.3100	3.1600	-0.	-0.	-0.	-0.
135.00	1.1000	9.0000	13.430	130.58	2.2500	2.0100	6.0800	74.240	2.0300	1.7200	8.8900	97.140	2.4800	2.1400
135.00	1.2000	9.0000	8.9600	68.390	3.0300	3.0300	5.4700	18.750	3.2500	3.3400	-0.	-0.	-0.	-0.
136.00	1.1000	3.0000	23.580	178.47	2.1600	1.6500	23.330	165.15	1.5500	.96000	19.000	145.09	1.8300	1.2600
136.00	1.2000	3.0000	17.720	177.40	1.9000	1.1800	13.890	145.99	1.1700	.68000	-0.	-0.	-0.	-0.
137.00	1.1000	11.000	13.460	133.82	1.3600	.90000	9.6300	101.75	1.2600	.42000	12.200	104.58	1.5700	.88000
137.00	1.2000	11.000	11.750	120.40	1.7400	1.5900	7.7600	90.080	1.1600	.97000	-0.	-0.	-0.	-0.
138.00	1.1000	3.0000	33.050	217.56	1.8700	1.2600	24.690	209.38	1.0500	.65000	28.730	174.03	1.2300	.68000
138.00	1.2000	3.0000	33.170	214.10	1.0900	-0.	26.160	205.67	.57000	-0.	-0.	-0.	-0.	-0.
139.00	1.1000	3.0000	37.710	366.08	.80000	.25000	29.540	290.84	.61000	.14000	39.510	333.33	.59000	.22000
139.00	1.2000	3.0000	17.680	290.67	.61000	.61000	14.230	221.45	.49000	.34000	-0.	-0.	-0.	-0.
140.00	1.1000	9.0000	4.8300	96.540	3.3600	2.4400	3.8500	69.150	2.4300	1.8500	5.9100	96.420	2.2600	1.5500
140.00	1.2000	9.0000	6.2400	102.96	2.8000	2.8500	4.6400	78.630	2.0900	1.9500	-0.	-0.	-0.	-0.
141.00	1.1000	1.0000	17.200	256.71	4.0000	-0.	17.020	203.09	5.1200	-0.	23.570	232.59	4.5100	-0.
141.00	1.2000	1.0000	13.820	225.33	.71000	.66000	13.370	194.28	.58000	.27000	-0.	-0.	-0.	-0.
142.00	1.1000	9.0000	7.1800	65.070	2.8100	2.7600	5.4400	51.780	2.1100	1.8600	5.6700	53.990	2.5200	2.1400
142.00	1.2000	9.0000	8.0300	81.790	2.7600	2.5200	5.4000	71.510	1.8000	1.6500	-0.	-0.	-0.	-0.
143.00	1.1000	5.0000	14.780	127.00	5.6500	5.0600	9.8300	98.810	3.4500	3.3300	12.150	95.890	4.6900	4.3800
143.00	1.2000	5.0000	11.510	105.32	6.1500	-0.	8.2500	75.690	4.1100	-0.	-0.	-0.	-0.	-0.
144.00	1.1000	8.0000	34.870	103.55	2.8900	2.5400	23.630	60.000	2.2700	1.9400	24.610	68.410	2.5300	2.1600
144.00	1.2000	8.0000	11.030	175.36	1.4300	-0.	5.0200	100.31	1.4100	-0.	-0.	-0.	-0.	-0.
145.00	1.1000	9.0000	8.6100	98.110	4.3700	4.2800	5.5400	52.080	3.6400	3.2900	7.4600	78.880	4.3600	4.1400
145.00	1.2000	9.0000	8.0300	95.000	3.9800	3.6000	5.1300	43.550	3.3100	2.8200	-0.	-0.	-0.	-0.
146.00	1.1000	11.000	16.530	201.00	3.1600	3.2000	5.0700	70.220	1.8700	1.9500	6.0100	59.080	2.6600	2.7000
146.00	1.2000	11.000	13.940	189.13	1.4000	1.2500	5.5500	123.03	1.0000	.55000	-0.	-0.	-0.	-0.
147.00	1.1000	3.0000	9.9900	104.43	3.2300	1.8600	7.4200	78.430	2.0600	1.2000	8.8400	78.740	3.0400	1.9200
147.00	1.2000	3.0000	8.8500	111.94	2.7900	1.8800	6.9100	84.110	2.0200	1.2000	-0.	-0.	-0.	-0.
148.00	1.1000	5.0000	15.710	371.54	1.1600	.54000	4.5800	152.21	1.1900	.70000	6.9100	231.04	1.1600	.68000
148.00	1.2000	5.0000	9.1000	38.220	4.2600	-0.	7.1300	27.400	4.2100	-0.	-0.	-0.	-0.	-0.
149.00	1.1000	1.0000	10.330	131.97	6.1300	3.3100	7.9300	96.460	5.1300	3.3900	6.9900	89.540	7.4100	4.6100
149.00	1.2000	1.0000	8.2700	79.510	8.7200	7.6600	6.0200	56.530	6.0800	5.9100	-0.	-0.	-0.	-0.
150.00	1.1000	9.0000	20.750	166.52	5.9400	2.8800	13.110	105.11	4.4100	2.8400	14.170	107.83	8.3700	3.6600
150.00	1.2000	9.0000	17.930	133.32	4.8800	4.3600	11.200	66.250	3.6400	3.2900	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			11.416	126.94	4.1004	2.6477	7.7263	81.137	3.2035	2.0786	10.911	97.506	3.6725	2.3134
ESTIMATE OF STANDARD DEVIATION			5.9985	58.444	2.1047	1.3994	4.6090	40.688	1.6568	1.2759	6.8482	49.447	2.0295	1.3071
DEGREES OF FREEDOM			297	297	297	55	297	297	297	56	146	146	146	28
T VALUE			32.855	37.493	33.631	14.159	28.938	34.424	33.379	12.300	19.318	23.909	21.940	9.5313

10

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
1.0000	2.0000	9.0000	5.3200	56.850	5.3100	4.7400	3.3500	42.010	3.5500	3.4700	-0.	-0.	-0.	-0.
2.0000	2.0000	5.0000	33.200	214.51	-0.	2.8300	16.710	154.19	-0.	1.3700	-0.	-0.	-0.	-0.
3.0000	2.0000	10.000	15.060	182.54	4.5500	4.2400	8.8300	107.56	4.1300	3.7500	-0.	-0.	-0.	-0.
4.0000	2.0000	1.0000	5.3300	120.31	2.0500	2.0900	3.4600	80.460	2.0700	2.0300	-0.	-0.	-0.	-0.
5.0000	2.0000	8.0000	6.4900	94.530	3.2700	3.3100	4.8400	67.800	2.0700	2.1900	-0.	-0.	-0.	-0.
6.0000	2.0000	9.0000	20.780	303.47	1.5200	1.5600	7.5900	88.320	2.0100	2.9300	-0.	-0.	-0.	-0.
7.0000	2.0000	12.000	9.5400	76.940	2.6700	2.8900	7.8700	63.540	1.7300	1.8600	-0.	-0.	-0.	-0.
8.0000	2.0000	1.0000	18.000	274.08	1.8900	.94000	7.0700	94.210	2.5600	1.2800	-0.	-0.	-0.	-0.
9.0000	2.0000	4.0000	16.220	145.81	4.4300	4.1900	13.380	110.48	2.8700	2.7600	-0.	-0.	-0.	-0.
10.000	2.0000	3.0000	6.9300	66.190	5.6800	5.4200	5.4000	49.860	4.0700	4.1500	-0.	-0.	-0.	-0.
11.000	2.0000	5.0000	7.3300	97.060	3.5700	3.6600	5.8800	72.350	2.9000	2.9900	-0.	-0.	-0.	-0.
12.000	2.0000	3.0000	7.6900	89.400	1.8700	1.9900	7.6000	118.04	1.3500	1.1100	-0.	-0.	-0.	-0.
13.000	2.0000	3.0000	9.9100	130.16	3.5800	-0.	7.2300	96.080	2.3600	-0.	-0.	-0.	-0.	-0.
15.000	2.0000	3.0000	13.540	130.60	3.8700	-0.	7.0400	68.950	3.8800	-0.	-0.	-0.	-0.	-0.
16.000	2.0000	9.0000	10.590	102.67	4.9100	4.6900	5.5000	56.300	3.4100	3.3800	-0.	-0.	-0.	-0.
17.000	2.0000	7.0000	6.3300	96.220	3.7200	3.7200	3.9900	52.860	2.1800	2.4500	-0.	-0.	-0.	-0.
18.000	2.0000	7.0000	4.3500	64.030	4.1500	4.1500	3.3200	66.410	1.7700	1.9900	-0.	-0.	-0.	-0.
19.000	2.0000	4.0000	16.900	153.67	6.2500	5.7600	12.440	109.06	3.8900	3.7600	-0.	-0.	-0.	-0.
20.000	2.0000	9.0000	5.2000	45.930	-0.	4.3600	4.4500	49.570	-0.	2.3500	-0.	-0.	-0.	-0.
21.000	2.0000	9.0000	10.560	206.87	-0.	1.4800	4.6000	55.900	-0.	2.0300	-0.	-0.	-0.	-0.
22.000	2.0000	7.0000	12.140	168.15	-0.	3.4600	8.9500	81.980	-0.	1.0300	-0.	-0.	-0.	-0.
23.000	2.0000	2.0000	7.9700	105.17	-0.	6.5100	4.8800	50.730	-0.	6.1600	-0.	-0.	-0.	-0.
24.000	2.0000	9.0000	16.380	114.48	-0.	4.4700	10.970	95.750	-0.	3.0000	-0.	-0.	-0.	-0.
25.000	2.0000	3.0000	7.2400	92.140	3.7900	2.7400	5.0300	59.470	3.1500	2.3300	-0.	-0.	-0.	-0.
26.000	2.0000	12.000	14.470	95.460	2.4900	2.5300	5.4600	65.830	1.0100	1.7300	-0.	-0.	-0.	-0.
27.000	2.0000	5.0000	9.4400	113.23	-0.	5.0400	7.7800	67.950	-0.	3.7900	-0.	-0.	-0.	-0.
30.000	2.0000	3.0000	40.930	165.75	-0.	2.4200	28.940	54.400	-0.	2.0800	-0.	-0.	-0.	-0.
31.000	2.0000	6.0000	12.570	235.63	-0.	2.2800	7.2600	117.97	-0.	3.3900	-0.	-0.	-0.	-0.
32.000	2.0000	1.0000	9.0200	71.110	-0.	5.3700	6.4000	44.700	-0.	4.8200	-0.	-0.	-0.	-0.
33.000	2.0000	8.0000	7.2200	139.55	3.6400	3.7400	4.0500	63.070	3.7200	3.6700	-0.	-0.	-0.	-0.
35.000	2.0000	12.000	12.057	100.97	1.8107	1.9293	8.3500	89.500	.65000	.65000	-0.	-0.	-0.	-0.
36.000	2.0000	3.0000	11.290	89.960	5.0100	5.3400	7.6500	67.040	3.7300	3.6400	-0.	-0.	-0.	-0.
37.000	2.0000	3.0000	10.930	108.04	-0.	2.3600	5.7300	73.720	-0.	1.7500	-0.	-0.	-0.	-0.
38.000	2.0000	4.0000	16.310	138.09	6.1000	5.6900	9.1600	85.960	3.9000	3.8500	-0.	-0.	-0.	-0.
39.000	2.0000	1.0000	12.990	147.30	3.0800	3.0300	10.350	95.130	2.2800	2.5300	-0.	-0.	-0.	-0.
40.000	2.0000	12.000	12.200	83.210	3.4500	3.6400	7.8100	67.320	2.3200	2.1900	-0.	-0.	-0.	-0.
41.000	2.0000	3.0000	14.640	142.71	2.8900	2.9900	6.1200	80.820	2.2100	2.1600	-0.	-0.	-0.	-0.
42.000	2.0000	3.0000	22.541	201.73	1.3800	1.1240	10.920	136.90	1.2300	.66000	-0.	-0.	-0.	-0.
43.000	2.0000	3.0000	12.860	117.85	4.0800	3.8900	10.230	92.230	2.9900	2.9400	-0.	-0.	-0.	-0.
44.000	2.0000	3.0000	16.440	128.76	2.4100	2.3100	11.620	85.200	1.5200	1.2900	-0.	-0.	-0.	-0.
45.000	2.0000	3.0000	14.880	148.26	3.5000	3.7100	7.0400	68.340	2.9100	2.8100	-0.	-0.	-0.	-0.
46.000	2.0000	3.0000	25.450	237.72	2.4200	2.6900	12.740	142.86	4.4900	2.8000	-0.	-0.	-0.	-0.
47.000	2.0000	3.0000	13.330	123.70	3.7100	3.8000	9.3200	92.620	2.0200	2.0600	-0.	-0.	-0.	-0.
48.000	2.0000	3.0000	11.330	169.36	2.6200	2.5600	6.7200	76.930	2.6300	2.4300	-0.	-0.	-0.	-0.
49.000	2.0000	9.0000	17.980	263.18	2.4600	2.5900	9.0300	136.59	2.1300	2.3400	-0.	-0.	-0.	-0.
50.000	2.0000	3.0000	9.0900	120.63	5.0000	-0.	4.0900	49.510	3.4500	-0.	-0.	-0.	-0.	-0.
51.000	2.0000	4.0000	31.150	276.48	2.8900	-0.	8.8000	114.49	3.0000	-0.	-0.	-0.	-0.	-0.
52.000	2.0000	11.000	9.7700	140.66	3.4700	-0.	5.0300	71.830	2.7400	-0.	-0.	-0.	-0.	-0.
53.000	2.0000	12.000	13.230	105.82	1.7700	1.8100	7.1000	86.280	1.0700	1.0000	-0.	-0.	-0.	-0.
55.000	2.0000	3.0000	9.6200	134.09	3.0200	2.8500	4.6600	67.260	2.4500	2.3700	-0.	-0.	-0.	-0.
56.000	2.0000	9.0000	8.8900	104.98	6.2900	5.4900	4.8400	54.170	4.6700	4.3300	-0.	-0.	-0.	-0.
57.000	2.0000	3.0000	5.0300	68.470	5.1500	4.9300	3.0100	41.640	3.0900	2.8800	-0.	-0.	-0.	-0.
58.000	2.0000	4.0000	15.190	112.96	5.5300	5.1400	11.900	89.470	3.6400	3.6000	-0.	-0.	-0.	-0.
59.000	2.0000	6.0000	17.480	302.00	2.1200	1.8100	6.0400	54.590	5.0300	5.1600	-0.	-0.	-0.	-0.
60.000	2.0000	9.0000	23.860	222.61	2.3800	-0.	8.2800	130.44	1.8700	-0.	-0.	-0.	-0.	-0.
61.000	2.0000	5.0000	8.2200	201.16	.80000	.66000	4.3500	134.18	.41000	.33000	-0.	-0.	-0.	-0.
63.000	2.0000	9.0000	9.5000	125.42	4.3200	4.3600	6.9700	76.020	3.6000	3.8600	-0.	-0.	-0.	-0.
65.000	2.0000	3.0000	6.4900	48.430	7.2000	6.3000	3.7400	14.810	4.8700	4.7700	-0.	-0.	-0.	-0.
66.000	2.0000	3.0000	9.3900	84.530	6.4500	6.0800	4.7300	46.960	3.4900	3.6900	-0.	-0.	-0.	-0.
67.000	2.0000	8.0000	9.7200	120.16	5.8200	5.5900	5.1900	74.590	3.2000	3.2800	-0.	-0.	-0.	-0.
70.000	2.0000	12.000	9.8800	86.140	2.2400	2.2900	4.7000	55.690	2.3700	2.2400	-0.	-0.	-0.	-0.
71.000	2.0000	5.0000	9.4700	83.960	2.3800	2.2900	12.920	36.610	1.4600	1.4600	-0.	-0.	-0.	-0.
72.000	2.0000	3.0000	5.5700	53.860	2.6100	2.7900	3.4600	27.780	2.5300	2.6100	-0.	-0.	-0.	-0.
73.000	2.0000	9.0000	10.440	177.50	1.5500	1.4200	5.1400	102.86	1.2200	1.0500	-0.	-0.	-0.	-0.
74.000	2.0000	1.0000	10.240	154.34	2.4400	2.4000	4.9600	96.770	1.9200	1.7900	-0.	-0.	-0.	-0.
75.000	2.0000	8.0000	32.810	266.43	1.4400	.99000	14.020	73.310	2.2600	1.9500	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
76.000	2.0000	9.0000	3.9200	36.400	9.5800	7.8700	5.0300	11.210	6.8500	6.1100	-0.	-0.	-0.	-0.
77.000	2.0000	9.0000	12.060	93.800	4.9200	4.7500	8.0200	82.860	3.3000	3.0100	-0.	-0.	-0.	-0.
78.000	2.0000	11.000	7.5000	86.020	3.0500	2.9100	3.9500	45.790	2.7800	2.6500	-0.	-0.	-0.	-0.
80.000	2.0000	5.0000	4.5100	62.650	.72000	.48000	4.5500	102.21	1.7000	1.2500	-0.	-0.	-0.	-0.
82.000	2.0000	3.0000	9.8000	128.00	3.2800	3.0100	5.7800	56.070	2.8700	2.6900	-0.	-0.	-0.	-0.
83.000	2.0000	9.0000	11.520	95.040	2.6900	2.6000	6.6000	70.500	2.0300	1.7000	-0.	-0.	-0.	-0.
84.000	2.0000	7.0000	6.9900	126.01	4.3900	3.8300	4.5900	87.120	3.2000	2.7900	-0.	-0.	-0.	-0.
85.000	2.0000	9.0000	9.2000	91.590	6.3700	4.8300	6.4300	73.490	4.4900	3.7100	-0.	-0.	-0.	-0.
87.000	2.0000	1.0000	10.310	154.05	2.0100	1.8900	6.6200	84.420	1.5700	1.4500	-0.	-0.	-0.	-0.
88.000	2.0000	6.0000	8.1600	89.980	4.9200	4.2900	4.2900	50.110	4.3500	3.8700	-0.	-0.	-0.	-0.
89.000	2.0000	3.0000	5.8600	54.970	4.1000	3.9300	3.6800	22.970	3.5900	3.5500	-0.	-0.	-0.	-0.
90.000	2.0000	2.0000	9.6500	125.35	5.1300	4.7300	8.2500	95.320	3.5400	3.5000	-0.	-0.	-0.	-0.
91.000	2.0000	4.0000	12.239	216.30	1.2920	1.2120	[illegible].5800	157.35	1.1900	.75000	-0.	-0.	-0.	-0.
92.000	2.0000	9.0000	7.9200	62.580	4.4300	4.2500	5.2000	35.750	3.3500	3.4300	-0.	-0.	-0.	-0.
93.000	2.0000	2.0000	6.7100	81.390	5.9100	5.4800	4.4000	48.770	4.3500	4.1700	-0.	-0.	-0.	-0.
94.000	2.0000	3.0000	16.070	169.20	3.8300	3.6900	9.9300	106.36	3.2200	2.8500	-0.	-0.	-0.	-0.
95.000	2.0000	9.0000	13.850	153.55	2.6500	3.2000	12.400	146.53	2.5100	2.5100	-0.	-0.	-0.	-0.
96.000	2.0000	7.0000	9.1700	147.16	3.3200	3.4400	5.8600	96.420	2.1200	2.0300	-0.	-0.	-0.	-0.
97.000	2.0000	9.0000	14.480	213.31	3.8300	3.7900	7.9500	116.79	4.4300	4.0600	-0.	-0.	-0.	-0.
98.000	2.0000	11.000	10.270	56.600	4.7400	4.1600	4.9900	31.870	4.0000	3.2900	-0.	-0.	-0.	-0.
99.000	2.0000	4.0000	42.870	196.88	1.2700	1.7500	28.920	82.280	2.2100	2.2100	-0.	-0.	-0.	-0.
100.00	2.0000	5.0000	11.600	109.04	1.9600	2.1300	5.1400	52.900	1.9300	1.8900	-0.	-0.	-0.	-0.
101.00	2.0000	5.0000	6.7333	79.523	4.8413	4.8947	3.7600	38.030	4.5000	4.3400	-0.	-0.	-0.	-0.
102.00	2.0000	9.0000	5.0400	96.940	1.7200	1.4800	6.5300	77.940	.61000	.81000	-0.	-0.	-0.	-0.
103.00	2.0000	10.000	12.016	158.20	3.3413	3.3573	7.2000	103.98	2.7600	2.7200	-0.	-0.	-0.	-0.
104.00	2.0000	8.0000	9.9100	107.09	2.6100	2.4700	7.2200	68.510	2.4600	2.2000	-0.	-0.	-0.	-0.
105.00	2.0000	5.0000	7.6200	168.43	1.5200	1.5700	5.1500	107.62	1.1300	1.0000	-0.	-0.	-0.	-0.
107.00	2.0000	8.0000	9.5800	152.05	2.2400	2.4200	4.6500	83.660	1.7700	1.8200	-0.	-0.	-0.	-0.
108.00	2.0000	7.0000	10.159	180.03	1.2880	.99067	5.2500	78.770	1.4500	1.2100	-0.	-0.	-0.	-0.
109.00	2.0000	11.000	10.720	155.32	1.9500	1.8600	8.2000	114.91	1.3400	1.0300	-0.	-0.	-0.	-0.
110.00	2.0000	3.0000	11.325	104.50	4.3000	4.2973	8.5300	100.30	3.8500	3.6100	-0.	-0.	-0.	-0.
113.00	2.0000	3.0000	29.784	102.03	4.2520	4.7440	24.180	52.320	4.3600	4.1100	-0.	-0.	-0.	-0.
114.00	2.0000	9.0000	9.3040	129.39	4.2307	4.2587	5.9400	56.110	4.1300	3.9700	-0.	-0.	-0.	-0.
115.00	2.0000	9.0000	12.169	157.10	6.0347	6.0027	5.1800	50.730	6.3300	6.3300	-0.	-0.	-0.	-0.
117.00	2.0000	9.0000	8.4040	68.237	6.9213	6.8333	5.7200	51.120	4.5900	4.8100	-0.	-0.	-0.	-0.
118.00	2.0000	12.000	9.6813	74.828	3.5227	3.3120	7.5700	59.190	2.4700	2.3500	-0.	-0.	-0.	-0.
119.00	2.0000	3.0000	12.980	96.893	1.7160	1.6320	9.0400	82.590	1.1600	1.0100	-0.	-0.	-0.	-0.
120.00	2.0000	3.0000	12.013	114.15	2.9147	2.8827	5.1200	75.150	2.1700	1.9300	-0.	-0.	-0.	-0.
121.00	2.0000	3.0000	107.84	80.623	-0.	4.2240	73.950	78.430	-0.	2.6300	-0.	-0.	-0.	-0.
124.00	2.0000	9.0000	11.649	102.83	4.4040	4.1373	8.6700	80.980	3.0300	2.5700	-0.	-0.	-0.	-0.
125.00	2.0000	9.0000	14.197	86.741	4.3440	4.2240	8.4800	60.040	3.4800	3.4800	-0.	-0.	-0.	-0.
126.00	2.0000	9.0000	8.7147	79.813	2.9187	2.6360	6.2200	57.170	1.7800	1.6100	-0.	-0.	-0.	-0.
127.00	2.0000	3.0000	12.448	111.65	2.5107	2.6720	8.6100	94.620	1.7900	1.6300	-0.	-0.	-0.	-0.
128.00	2.0000	7.0000	11.796	166.21	1.1960	1.0613	5.4900	118.40	.73000	.45000	-0.	-0.	-0.	-0.
130.00	2.0000	4.0000	15.744	147.08	2.4840	2.6240	11.400	112.72	2.4600	2.1900	-0.	-0.	-0.	-0.
131.00	2.0000	10.000	17.639	192.32	3.8507	4.0853	7.4600	138.82	1.5500	1.2800	-0.	-0.	-0.	-0.
132.00	2.0000	4.0000	11.477	88.729	3.8453	4.2453	7.5900	58.590	3.4400	2.9700	-0.	-0.	-0.	-0.
133.00	2.0000	3.0000	10.851	120.67	4.1187	4.1360	9.2500	79.310	4.3200	4.2700	-0.	-0.	-0.	-0.
134.00	2.0000	3.0000	7.8360	77.431	3.0027	3.2600	5.4600	61.190	2.3300	2.3700	-0.	-0.	-0.	-0.
135.00	2.0000	9.0000	9.8733	83.704	3.3413	3.1720	5.1100	44.650	3.0400	2.6500	-0.	-0.	-0.	-0.
136.00	2.0000	3.0000	18.008	158.11	1.6787	1.4733	11.560	127.39	1.4000	1.0200	-0.	-0.	-0.	-0.
137.00	2.0000	11.000	9.3067	116.49	1.6653	1.8933	4.9700	91.140	1.1700	1.0200	-0.	-0.	-0.	-0.
139.00	2.0000	3.0000	23.137	267.53	.63333	.42000	18.870	225.69	.44000	.44000	-0.	-0.	-0.	-0.
140.00	2.0000	9.0000	5.8707	84.139	2.6587	2.7613	4.1700	65.310	2.4100	2.2100	-0.	-0.	-0.	-0.
141.00	2.0000	1.0000	8.7893	137.51	1.8827	1.8333	7.7200	120.43	1.5000	1.4200	-0.	-0.	-0.	-0.
142.00	2.0000	9.0000	8.3627	71.097	2.3187	2.2293	6.4400	72.990	1.2900	1.2900	-0.	-0.	-0.	-0.
143.00	2.0000	5.0000	25.675	113.29	5.3667	5.0653	9.5000	74.360	4.0500	3.6800	-0.	-0.	-0.	-0.
145.00	2.0000	9.0000	4.9600	57.591	3.2853	3.2360	2.5200	24.020	2.7300	2.3200	-0.	-0.	-0.	-0.
146.00	2.0000	11.000	14.367	150.92	1.7800	1.5987	6.8100	107.91	1.3300	.84000	-0.	-0.	-0.	-0.
147.00	2.0000	3.0000	10.243	107.44	3.7280	3.2387	7.0800	67.100	2.1400	2.2300	-0.	-0.	-0.	-0.
148.00	2.0000	5.0000	9.0693	112.81	6.5800	5.4640	4.6700	21.260	7.6100	6.4500	-0.	-0.	-0.	-0.
149.00	2.0000	1.0000	11.263	129.69	8.0107	6.6293	7.5000	78.450	6.3000	5.5200	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
ESTIMATE OF MEAN			13.033	126.94	3.5060	3.3867	8.0226	79.338	2.7966	2.6359	0.	0.	0.	0.
ESTIMATE OF STANDARD DEVIATION			10.797	56.853	1.6788	1.5267	7.2079	32.681	1.3301	1.3125	-0.	-0.	-0.	-0.
DEGREES OF FREEDOM			127	127	115	121	127	127	115	121	0	0	0	0
T VALUE			13.656	25.659	22.493	24.502	12.592	27.465	22.645	22.182	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
1.0000	3.0000	9.0000	6.5920	68.388	4.1987	4.0747	5.1500	50.310	3.4900	3.2700	-0.	-0.	-0.	-0.
2.0000	3.0000	5.0000	21.959	223.44	1.2093	1.0080	10.720	133.83	2.0700	1.9600	-0.	-0.	-0.	-0.
3.0000	3.0000	10.000	12.639	164.97	2.5227	2.4360	10.450	142.14	3.3300	3.1800	-0.	-0.	-0.	-0.
4.0000	3.0000	1.0000	5.8067	108.75	2.4120	2.3453	3.5200	52.240	2.6000	2.5000	-0.	-0.	-0.	-0.
5.0000	3.0000	8.0000	8.7133	112.88	3.6027	3.3667	6.7800	79.010	2.5700	2.3300	-0.	-0.	-0.	-0.
6.0000	3.0000	9.0000	18.924	250.17	1.1640	.95200	6.7300	61.800	2.3200	2.0600	-0.	-0.	-0.	-0.
7.0000	3.0000	12.000	12.212	80.399	1.7040	1.5880	8.4000	59.850	1.1900	1.1000	-0.	-0.	-0.	-0.
8.0000	3.0000	1.0000	9.7347	174.96	2.9347	2.7213	6.1600	116.04	2.6800	2.2500	-0.	-0.	-0.	-0.
10.000	3.0000	3.0000	8.4067	76.515	4.9147	4.3147	5.1600	56.740	3.5700	3.2300	-0.	-0.	-0.	-0.
12.000	3.0000	3.0000	6.5160	92.125	1.2040	1.6093	5.8700	78.700	.93000	.89000	-0.	-0.	-0.	-0.
13.000	3.0000	3.0000	9.0827	103.66	2.2987	2.1680	7.1900	83.420	1.6700	1.5500	-0.	-0.	-0.	-0.
15.000	3.0000	3.0000	12.348	125.84	3.2040	3.0080	6.4900	70.380	2.6700	2.4700	-0.	-0.	-0.	-0.
16.000	3.0000	9.0000	10.395	97.272	2.7547	3.0733	7.6800	66.180	2.4600	2.7000	-0.	-0.	-0.	-0.
17.000	3.0000	7.0000	14.196	128.11	3.2307	2.9093	3.0200	13.330	4.8400	4.2200	-0.	-0.	-0.	-0.
18.000	3.0000	7.0000	-0.	54.193	3.4880	3.1827	-0.	56.230	1.3900	1.5900	-0.	-0.	-0.	-0.
19.000	3.0000	4.0000	13.423	125.88	5.0400	4.3107	13.280	103.87	3.4500	2.9700	-0.	-0.	-0.	-0.
20.000	3.0000	9.0000	19.151	98.516	2.3613	2.0680	4.9200	64.760	1.5500	1.2700	-0.	-0.	-0.	-0.
21.000	3.0000	9.0000	9.3253	172.53	1.6213	1.3133	4.1600	30.110	2.5300	2.2000	-0.	-0.	-0.	-0.
22.000	3.0000	7.0000	32.315	319.29	.48267	.33200	3.3000	7.4900	2.0900	2.0100	-0.	-0.	-0.	-0.
23.000	3.0000	2.0000	6.0813	82.319	3.8187	3.4827	5.8200	61.160	3.7000	3.5000	-0.	-0.	-0.	-0.
25.000	3.0000	3.0000	7.2533	87.947	4.5720	4.5427	5.2600	62.600	3.6400	3.9600	-0.	-0.	-0.	-0.
26.000	3.0000	12.000	6.4587	73.883	1.8547	1.7400	4.3000	54.520	1.4700	1.1900	-0.	-0.	-0.	-0.
27.000	3.0000	5.0000	8.4920	96.841	3.2427	2.9027	6.2700	68.070	2.6200	2.3500	-0.	-0.	-0.	-0.
31.000	3.0000	3.0000	10.272	184.74	2.5200	1.9387	6.1400	92.780	2.8700	2.1700	-0.	-0.	-0.	-0.
32.000	3.0000	1.0000	9.7960	64.757	4.8987	4.3560	6.3500	37.860	4.4500	3.8100	-0.	-0.	-0.	-0.
33.000	3.0000	8.0000	7.1707	91.045	5.2133	4.4093	4.6200	55.520	4.1100	3.8400	-0.	-0.	-0.	-0.
37.000	3.0000	3.0000	12.909	120.62	3.4413	3.2627	7.1600	83.730	3.0000	2.5400	-0.	-0.	-0.	-0.
38.000	3.0000	4.0000	11.516	96.793	5.1867	4.5133	9.1400	72.370	3.8200	3.2600	-0.	-0.	-0.	-0.
39.000	3.0000	1.0000	10.652	63.732	4.0227	3.7573	10.360	25.950	3.8000	3.2400	-0.	-0.	-0.	-0.
40.000	3.0000	12.000	10.169	90.145	2.7613	2.3880	9.3300	70.050	2.6100	2.3600	-0.	-0.	-0.	-0.
43.000	3.0000	3.0000	11.400	98.504	3.5947	3.2627	9.2700	79.170	3.0900	2.6800	-0.	-0.	-0.	-0.
44.000	3.0000	3.0000	15.148	125.45	1.6133	1.7173	10.700	100.94	1.2900	1.1100	-0.	-0.	-0.	-0.
45.000	3.0000	3.0000	16.757	161.91	2.0613	1.8067	12.420	131.79	1.6000	1.2000	-0.	-0.	-0.	-0.
47.000	3.0000	3.0000	10.975	105.07	3.5773	3.1947	8.5200	85.820	2.6900	2.1900	-0.	-0.	-0.	-0.
48.000	3.0000	3.0000	9.4333	147.88	1.7667	1.4000	6.4400	83.430	1.9000	1.5500	-0.	-0.	-0.	-0.
49.000	3.0000	9.0000	13.984	221.10	2.7467	2.4640	9.1800	150.08	2.2700	1.9200	-0.	-0.	-0.	-0.
50.000	3.0000	3.0000	7.1800	89.457	4.0773	3.4627	4.0400	39.280	3.4000	2.7800	-0.	-0.	-0.	-0.
51.000	3.0000	4.0000	8.8920	110.67	4.6800	4.3160	6.3000	90.290	3.7000	2.7000	-0.	-0.	-0.	-0.
52.000	3.0000	11.000	10.671	107.53	2.2160	1.9933	7.1800	54.040	2.1700	1.7200	-0.	-0.	-0.	-0.
53.000	3.0000	12.000	10.745	104.50	1.7400	1.2253	8.5800	77.140	1.6000	1.0600	-0.	-0.	-0.	-0.
55.000	3.0000	3.0000	9.6773	151.42	3.7013	2.9627	5.3100	71.480	3.7600	2.7700	-0.	-0.	-0.	-0.
56.000	3.0000	9.0000	7.5840	103.02	5.7320	4.6373	5.1200	55.220	4.9500	4.3600	-0.	-0.	-0.	-0.
57.000	3.0000	3.0000	6.8947	95.408	3.9147	3.8680	4.9000	55.570	4.0200	3.6000	-0.	-0.	-0.	-0.
58.000	3.0000	4.0000	17.501	127.63	3.7720	3.8347	15.110	84.760	3.1800	2.5900	-0.	-0.	-0.	-0.
59.000	3.0000	3.0000	17.127	302.89	1.4933	.99333	6.8500	62.440	5.7800	5.0600	-0.	-0.	-0.	-0.
60.000	3.0000	9.0000	12.260	140.31	2.5707	2.3867	9.3300	124.40	2.1200	1.6400	-0.	-0.	-0.	-0.
63.000	3.0000	9.0000	9.8040	147.07	4.0827	3.8787	6.3400	81.860	4.9900	4.2000	-0.	-0.	-0.	-0.
65.000	3.0000	3.0000	24.040	57.380	5.3120	4.7107	3.3900	30.040	5.0800	4.4400	-0.	-0.	-0.	-0.
67.000	3.0000	8.0000	7.2213	109.96	4.1147	4.0000	4.7300	75.850	3.6800	3.1100	-0.	-0.	-0.	-0.
75.000	3.0000	8.0000	30.989	134.59	1.2427	1.0200	11.220	94.760	3.1500	2.7900	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			12.057	125.45	3.1182	2.8242	7.1155	72.828	2.9582	2.5888	0.	0.	0.	0.
ESTIMATE OF STANDARD DEVIATION			5.8138	57.126	1.3072	1.1904	2.7249	30.676	1.1283	1.0071	-0.	-0.	-0.	-0.
DEGREES OF FREEDOM			48	49	49	49	48	49	49	49	0	0	0	0
T VALUE			14.517	15.528	16.868	16.777	18.279	16.788	18.539	18.177	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES

CAR NO	TEST NO	CAR MAKE	HC 72HOT	CO 72HOT	NOX 72HOT	NOXP 72HOT	HC 75COLD	CO 75COLD	NOX 75COLD	NOXP 75CLD
1.0000	3.0000	9.0000	6.0307	65.551	3.9640	3.7560	6.2720	66.771	4.0649	3.8930
2.0000	3.0000	5.0000	14.799	153.27	2.0453	1.9080	17.877	183.44	1.6859	1.5210
3.0000	3.0000	10.000	9.7213	118.49	3.4440	3.1400	10.976	138.48	3.0478	2.8373
4.0000	3.0000	1.0000	4.3787	79.053	2.8493	2.6747	4.9927	91.823	2.6613	2.5331
5.0000	3.0000	8.0000	7.4387	76.177	4.3120	3.7320	7.9868	91.960	4.0070	3.5749
6.0000	3.0000	9.0000	8.6480	114.82	2.1080	1.8253	13.067	173.02	1.7107	1.4498
7.0000	3.0000	12.000	11.535	70.385	1.6547	1.5533	11.826	74.691	1.6759	1.5682
8.0000	3.0000	1.0000	7.6307	172.14	2.1533	1.9507	8.5354	173.35	2.4893	2.2821
10.000	3.0000	3.0000	6.3920	54.401	4.7653	4.1507	7.2583	63.910	4.8295	4.2212
12.000	3.0000	3.0000	6.1960	93.916	1.0520	1.3160	6.3336	93.146	1.1174	1.4421
13.000	3.0000	3.0000	7.9267	85.485	2.0173	1.8400	8.4237	93.301	2.1383	1.9810
15.000	3.0000	3.0000	7.7133	80.849	3.5627	3.0627	9.7062	100.20	3.4084	3.0392
16.000	3.0000	9.0000	9.4187	78.477	3.7053	3.4227	9.8383	86.559	3.2965	3.2725
17.000	3.0000	7.0000	3.8827	28.295	5.2813	4.4360	8.3174	71.217	4.3995	3.7795
18.000	3.0000	7.0000	-0.	56.169	3.0293	2.6907	-0.	55.320	3.2266	2.9022
19.000	3.0000	4.0000	12.496	123.70	4.3507	3.5573	12.894	124.64	4.6471	3.8813
20.000	3.0000	9.0000	7.9440	86.227	2.2213	1.8480	12.763	91.511	2.2815	1.9426
21.000	3.0000	9.0000	5.0640	70.500	2.4240	2.0667	6.8964	114.37	2.0789	1.7427
22.000	3.0000	7.0000	20.660	173.39	2.0507	1.7567	25.672	236.13	1.3764	1.1452
23.000	3.0000	2.0000	5.6173	83.855	3.6320	3.3307	5.8169	83.194	3.7123	3.3960
25.000	3.0000	3.0000	5.7213	64.801	4.9040	4.6827	6.3801	74.754	4.7612	4.6225
26.000	3.0000	12.000	5.6640	68.231	1.9440	1.7067	6.0057	70.661	1.9056	1.7210
27.000	3.0000	5.0000	7.5480	96.228	3.0813	2.6880	7.9539	96.492	3.1507	2.7803
31.000	3.0000	3.0000	6.5720	110.93	3.8627	3.1520	8.1630	142.66	3.2853	2.6303
32.000	3.0000	1.0000	8.5360	54.453	5.1480	4.3187	9.0778	58.864	5.0408	4.3347
33.000	3.0000	8.0000	5.8947	72.864	5.2400	4.3347	6.4433	80.[illegible]82	5.2285	4.3668
37.000	3.0000	3.0000	9.9827	109.51	3.4427	2.9960	11.241	114.29	3.4421	3.1107
38.000	3.0000	4.0000	10.665	87.967	4.8333	4.2747	11.031	91.762	4.9853	4.3773
39.000	3.0000	1.0000	9.9200	40.337	4.3347	3.8467	10.235	50.397	4.2005	3.8083
40.000	3.0000	12.000	10.461	84.656	2.8000	2.4493	10.336	87.016	2.7834	2.4230
43.000	3.0000	3.0000	10.577	93.669	3.6507	3.1267	10.931	95.748	3.6266	3.1851
44.000	3.0000	3.0000	13.152	124.60	1.7587	1.5120	14.010	124.97	1.6962	1.6003
45.000	3.0000	3.0000	27.468	142.71	2.1693	1.6240	22.862	150.97	2.1229	1.7025
47.000	3.0000	3.0000	9.5573	92.900	3.4707	2.9720	10.167	98.134	3.5165	3.0677
48.000	3.0000	3.0000	7.4547	115.10	2.2653	1.7987	8.3055	129.20	2.0509	1.6272
49.000	3.0000	9.0000	10.123	156.00	3.6880	3.1253	11.783	183.99	3.2832	2.8410
50.000	3.0000	3.0000	4.7653	47.425	4.6880	3.8453	[illegible].8036	65.499	4.4254	3.6808
51.000	3.0000	4.0000	7.3093	101.21	4.2893	3.7600	7.9899	105.28	4.4573	3.9991
52.000	3.0000	11.000	9.0227	90.592	2.1560	1.7587	9.7313	97.877	2.1818	1.8596
53.000	3.0000	12.000	9.8587	93.525	1.4773	1.1347	10.240	98.244	1.5903	1.1737
55.000	3.0000	3.0000	6.3187	122.77	4.1253	3.0413	7.7629	135.09	3.9430	3.0075
56.000	3.0000	9.0000	6.0733	65.855	6.0720	5.0120	6.7229	81.836	5.9258	4.8509
57.000	3.0000	3.0000	5.2640	67.376	4.8160	4.1827	5.9652	79.430	4.4284	4.0474
58.000	3.0000	4.0000	16.192	114.93	4.3867	3.9667	16.755	120.39	4.1224	3.9099
59.000	3.0000	3.0000	9.6400	177.73	4.4320	3.3880	12.059	231.55	3.1684	2.3583
60.000	3.0000	9.0000	10.928	143.31	2.4227	2.1133	11.501	142.02	2.4863	2.2309
63.000	3.0000	9.0000	7.7800	113.47	5.2227	4.3567	8.6503	127.92	4.7325	4.1523
65.000	3.0000	3.0000	22.401	2062.3	5.4080	4.7933	23.106	1200.2	5.3667	4.7578
67.000	3.0000	8.0000	5.8840	89.172	4.8200	4.0267	6.4591	98.111	4.5167	4.0152
75.000	3.0000	8.0000	14.748	175.89	2.6520	2.7627	21.732	158.13	2.0460	2.0133
ESTIMATE OF MEAN			9.3668	136.91	3.4837	3.0154	10.524	131.98	3.3265	2.9332
ESTIMATE OF STANDARD DEVIATION			4.6341	280.18	1.2599	1.0611	4.7819	159.76	1.2322	1.0737
DEGREES OF FREEDOM			48	49	49	49	48	49	49	49
T VALUE			14.149	3.4553	19.552	20.095	15.405	5.8416	19.090	19.317

15

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
1.0000	1.1000	87130	192.72	2.0300	2578.2	-0.	372.11	2.4421	2187.6	-0.	529.88	7.8176	115.59	-0.
2.0000	1.1000	78344	247.40	1.7258	2123.7	-0.	435.62	4.6172	363.07	-0.	1215.6	10.034	88.111	-0.
3.0000	1.1000	85862	187.69	1.6477	2530.7	-0.	229.06	1.3135	2025.0	-0.	229.06	2.6276	193.56	-0.
4.0000	1.1000	67581	115.04	1.0807	2172.2	-0.	118.89	.21154	1460.1	-0.	242.99	3.8995	93.931	-0.
5.0000	1.1000	94980	137.75	2.2719	2612.0	-0.	176.00	2.0102	2142.4	-0.	396.78	4.3907	154.83	-0.
6.0000	1.1000	70818	287.17	3.0334	1345.8	-0.	369.70	2.8080	975.67	-0.	719.19	10.492	93.134	-0.
7.0000	1.1000	1.21307E+05	506.19	2.3375	2353.2	-0.	937.00	5.6034	941.75	-0.	1764.1	7.8392	98.505	-0.
8.0000	1.1000	82302	221.80	4.1636	1362.9	-0.	200.73	1.9082	1278.6	-0.	631.59	4.2819	237.13	-0.
9.0000	1.1000	1.20000E+05	360.24	4.6012	1155.8	-0.	538.91	4.3334	807.58	-0.	2135.7	8.2205	180.95	-0.
10.000	1.1000	1.12757E+05	198.57	1.5168	1756.3	-0.	269.82	1.5920	1093.5	-0.	404.05	5.8696	115.94	-0.
11.000	1.1000	87269	256.67	3.2986	1597.9	-0.	288.84	2.4538	1470.8	-0.	330.81	1.5808	366.46	-0.
12.000	1.1000	90595	346.32	5.3469	616.61	-0.	480.08	3.2122	967.33	-0.	793.47	11.323	70.419	-0.
13.000	1.1000	1.00788E+05	452.49	4.4821	1163.8	-0.	587.42	5.1223	707.26	-0.	692.64	5.4961	111.40	-0.
14.000	1.1000	48842	316.67	6.2878	615.31	-0.	440.40	2.2060	1791.0	-0.	964.59	8.2635	195.48	-0.
15.000	1.1000	1.00942E+05	267.36	1.3209	3188.5	-0.	381.52	1.8032	2469.5	-0.	760.06	8.0816	85.421	-0.
16.000	1.1000	55984	302.77	.65272	2933.7	-0.	487.18	1.1362	2006.0	-0.	509.98	8.3923	83.006	-0.
17.000	1.1000	1.11175E+05	202.20	4.3930	892.62	-0.	196.98	1.7997	1138.2	-0.	439.47	8.4408	109.80	-0.
18.000	1.1000	71903	205.40	4.0248	1438.5	-0.	255.56	3.8494	1044.5	-0.	270.21	1.2927	759.08	-0.
19.000	1.1000	84166	302.80	2.1538	2155.0	-0.	412.17	2.6065	1599.9	-0.	676.49	6.5601	175.34	-0.
20.000	1.1000	1.01823E+05	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
21.000	1.1000	80578	315.86	2.4505	1773.0	-0.	398.11	2.6744	1207.3	-0.	714.56	10.670	74.806	-0.
22.000	1.1000	67833	1074.5	13.441	93.467	-0.	2054.5	13.441	110.29	-0.	1162.7	9.7575	90.673	-0.
23.000	1.1000	77921	349.75	2.7688	1948.9	-0.	475.82	1.3508	1759.4	-0.	453.35	6.9240	105.58	-0.
24.000	1.1000	1.15660E+05	551.42	4.5642	1002.8	-0.	1170.4	6.0958	509.69	-0.	2043.0	10.342	81.202	-0.
25.000	1.1000	55776	319.89	4.8359	801.23	-0.	344.30	1.9606	927.63	-0.	679.91	12.074	63.597	-0.
26.000	1.1000	1.64447E+05	401.98	1.3751	1804.1	-0.	780.76	4.0826	1470.2	-0.	1180.9	9.9630	77.154	-0.
27.000	1.1000	68267	426.51	5.5885	886.90	-0.	573.28	4.3640	985.64	-0.	828.94	7.6722	80.287	-0.
28.000	1.1000	46470	387.72	3.9507	1360.7	-0.	553.87	3.9507	880.30	-0.	839.20	9.2169	80.061	-0.
29.000	1.1000	1.04583E+05	171.86	.71908	3404.1	-0.	231.93	.90321	2376.5	-0.	193.61	.72582	89.101	-0.
30.000	1.1000	1.35235E+05	314.10	3.0477	1687.8	-0.	415.75	5.0525	678.02	-0.	396.70	.16606	1105.6	-0.
31.000	1.1000	59516	292.33	4.0668	1507.9	-0.	344.02	2.9345	1573.2	-0.	457.74	4.7155	82.400	-0.
32.000	1.1000	90641	330.06	1.0690	3562.7	-0.	471.38	2.5674	1523.6	-0.	559.12	.93705	160.71	-0.
33.000	1.1000	1.03281E+05	272.46	3.5964	1553.1	-0.	351.69	2.3599	1577.2	-0.	354.45	2.6310	138.99	-0.
34.000	1.1000	66531	281.50	5.0252	1122.9	-0.	377.26	4.8841	889.37	-0.	257.85	1.1350	113.27	-0.
35.000	1.1000	79374	422.02	2.4036	2268.5	-0.	757.93	8.1343	203.34	-0.	2017.9	6.6714	88.925	-0.
36.000	1.1000	85988	220.63	.89383	1592.1	-0.	275.69	1.0619	983.56	-0.	427.62	3.1275	104.78	-0.
37.000	1.1000	85063	305.21	2.9262	1749.9	-0.	449.51	1.8404	1925.6	-0.	419.14	7.1181	99.032	-0.
38.000	1.1000	44184	223.11	1.0595	1579.0	-0.	234.00	1.3949	677.51	-0.	457.20	5.1362	88.226	-0.
39.000	1.1000	1.03595E+05	217.47	3.6575	1359.1	-0.	320.22	3.6676	807.25	-0.	418.07	5.6194	52.418	-0.
40.000	1.1000	87493	1623.7	3.2792	2469.2	-0.	2040.1	5.9966	601.62	-0.	7681.9	6.0373	207.57	-0.
41.000	1.1000	81747	509.58	1.8772	1912.5	-0.	604.25	2.9699	865.29	-0.	1425.1	6.0577	87.905	-0.
42.000	1.1000	1.43170E+05	487.31	3.9012	1075.1	-0.	735.22	6.1818	419.70	-0.	2405.8	11.598	108.41	-0.
43.000	1.1000	69920	294.59	1.5483	1980.8	-0.	454.79	1.8640	1217.1	-0.	607.15	7.1657	44.200	-0.
44.000	1.1000	77561	361.84	2.6243	1970.7	-0.	513.77	3.7111	1119.5	-0.	647.97	1.7668	52.788	-0.
45.000	1.1000	56809	448.45	3.8921	1240.0	-0.	825.77	5.2942	619.50	-0.	845.99	9.0931	99.450	-0.
46.000	1.1000	42406	922.13	3.6452	1777.2	-0.	1031.9	5.6011	886.43	-0.	1607.2	9.8615	98.579	-0.
47.000	1.1000	81191	429.55	3.1228	1937.1	-0.	579.83	3.5885	874.93	-0.	456.91	3.7671	51.549	-0.
48.000	1.1000	91233	320.22	4.6106	684.41	-0.	363.93	4.2893	315.53	-0.	345.55	5.1989	74.258	-0.
49.000	1.1000	75035	276.55	3.2196	1807.8	-0.	396.94	4.3059	922.20	-0.	318.20	4.5614	80.400	-0.
50.000	1.1000	63337	204.40	1.3877	3262.8	-0.	258.97	.85054	2159.3	-0.	385.48	3.3142	119.37	-0.
51.000	1.1000	37426	144.39	1.5822	1458.7	-0.	144.39	1.1597	959.64	-0.	141.70	1.4632	60.555	-0.
52.000	1.1000	51834	378.44	8.4512	286.27	-0.	342.00	1.7238	1490.6	-0.	581.05	7.4424	43.548	-0.
53.000	1.1000	31443	229.97	1.6659	2906.2	-0.	363.78	6.4469	332.69	-0.	498.61	6.4182	57.911	-0.
54.000	1.1000	78654	291.58	3.9749	1486.6	-0.	414.54	4.5088	1021.1	-0.	721.50	7.2878	82.863	-0.
55.000	1.1000	51257	284.00	2.7165	2374.8	-0.	353.86	1.8948	2080.4	-0.	587.53	3.1405	163.01	-0.
56.000	1.1000	46581	212.11	.75745	3350.0	-0.	282.20	1.1526	1982.2	-0.	228.51	3.2012	50.056	-0.
57.000	1.1000	1.02100E+05	125.96	.99063	1591.7	-0.	200.43	1.3692	830.23	-0.	285.81	5.1045	112.95	-0.
58.000	1.1000	58749	327.20	1.8532	2387.7	-0.	483.71	2.0912	1316.6	-0.	1242.7	7.7261	76.318	-0.
59.000	1.1000	93591	306.42	2.9375	1853.5	-0.	425.17	.35482	1302.8	-0.	587.26	6.0665	120.73	-0.
60.000	1.1000	94160	280.54	2.9678	2010.3	-0.	350.52	2.5284	1358.4	-0.	-0.	2.4435	127.80	-0.
61.000	1.1000	1.05829E+05	271.42	7.6498	237.85	-0.	403.11	6.9134	280.01	-0.	475.45	5.4489	66.750	-0.
62.000	1.1000	1.00769E+05	441.66	6.6461	454.58	-0.	556.25	6.1137	396.52	-0.	699.48	6.2397	110.54	-0.
63.000	1.1000	63691	255.90	.91846	2974.0	-0.	419.97	.92529	3013.4	-0.	823.81	9.9052	63.757	-0.
64.000	1.1000	31477	383.34	3.9147	638.85	-0.	639.64	6.6010	225.61	-0.	600.67	3.9869	76.939	-0.
65.000	1.1000	54957	225.35	1.6414	2667.5	-0.	421.90	5.6750	561.31	-0.	479.17	6.8350	103.72	-0.
66.000	1.1000	97023	271.62	1.6631	2649.0	-0.	402.84	2.7134	1437.7	-0.	637.86	6.5157	130.36	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
67.000	1.1000	1.08971E+05	222.79	2.0239	2435.2	-0.	351.70	3.9864	1034.5	-0.	398.81	4.6853	129.91	-0.
68.000	1.1000	71094	454.66	2.8898	2312.5	-0.	633.30	2.3134	1910.9	-0.	1629.7	8.1445	77.371	-0.
69.000	1.1000	1.05137E+05	2091.3	1.7037	1454.8	-0.	2865.8	2.8328	600.14	-0.	3869.5	3.5660	111.96	-0.
70.000	1.1000	40045	294.28	.99104	2526.1	-0.	502.61	3.7836	1173.6	-0.	773.53	9.7343	132.29	-0.
71.000	1.1000	68214	191.87	.33606	3015.0	-0.	236.79	.13506	1798.6	-0.	524.10	6.5809	115.96	-0.
72.000	1.1000	84663	251.95	2.5066	1942.8	-0.	240.66	.25374	2615.7	-0.	324.50	2.8700	303.66	-0.
73.000	1.1000	31257	269.08	2.5624	1419.8	-0.	375.33	3.5614	880.89	-0.	331.39	7.0551	144.17	-0.
74.000	1.1000	55115	323.05	2.7592	1955.6	-0.	409.37	2.7947	1385.1	-0.	425.36	2.6100	83.261	-0.
75.000	1.1000	83993	241.79	2.6573	1308.2	-0.	359.17	1.2912	1484.0	-0.	556.60	5.2304	65.674	-0.
76.000	1.1000	77974	183.27	.15223	3560.2	-0.	231.90	.20161	2962.1	-0.	288.08	4.4555	163.21	-0.
77.000	1.1000	74674	227.27	.46787	2110.7	-0.	318.29	2.0512	698.73	-0.	431.53	3.4176	155.61	-0.
78.000	1.1000	1.43523E+05	243.84	8.0512	193.96	-0.	130.77	.13442	1546.6	-0.	211.47	3.5525	60.411	-0.
79.000	1.1000	74612	368.01	6.1145	631.59	-0.	455.25	4.3428	516.87	-0.	795.18	6.5121	67.581	-0.
80.000	1.1000	90502	374.91	6.2292	572.30	-0.	499.49	4.1682	662.84	-0.	569.75	7.6988	117.20	-0.
81.000	1.1000	83733	212.70	4.2394	1053.0	-0.	176.62	.76618	1400.2	-0.	287.09	.39864	486.83	-0.
82.000	1.1000	84303	310.58	2.7687	1942.5	-0.	498.88	3.6645	1013.7	-0.	577.46	3.5550	103.37	-0.
83.000	1.1000	92826	367.67	.62160	2167.2	-0.	551.72	2.0975	735.97	-0.	1295.8	9.2106	76.212	-0.
84.000	1.1000	89609	278.50	2.5016	2037.9	-0.	426.78	5.1387	790.92	-0.	653.18	11.990	73.649	-0.
85.000	1.1000	29878	289.06	.72233	3465.6	-0.	403.20	1.3912	2513.7	-0.	458.35	6.8560	85.571	-0.
86.000	1.1000	74530	210.70	1.3533	1530.2	-0.	277.25	.46253	1073.0	-0.	238.91	1.9211	63.533	-0.
87.000	1.1000	62562	330.62	4.1123	1062.2	-0.	472.21	4.5476	608.48	-0.	571.38	8.6861	63.607	-0.
88.000	1.1000	84072	254.32	3.0235	1668.5	-0.	314.90	.43034	2498.1	-0.	487.66	7.3481	83.261	-0.
89.000	1.1000	54185	240.32	3.6659	742.36	-0.	317.33	.93661	1348.8	-0.	292.96	1.9476	45.262	-0.
90.000	1.1000	76195	237.50	1.6161	2114.1	-0.	118.03	.19598	568.04	-0.	82.048	.68357	9.1535	-0.
91.000	1.1000	68864	165.72	.79821	1786.3	-0.	269.30	2.0614	685.24	-0.	363.38	4.4688	79.017	-0.
92.000	1.1000	56137	202.93	10.807	150.76	-0.	161.15	5.6974	210.25	-0.	135.38	2.0210	267.38	-0.
93.000	1.1000	49392	236.08	2.1064	1584.5	-0.	284.66	.64154	1129.2	-0.	276.06	1.5874	108.49	-0.
94.000	1.1000	81580	427.94	3.1793	1653.9	-0.	613.02	2.9311	1150.5	-0.	1674.7	4.4636	77.382	-0.
95.000	1.1000	63632	1985.7	1.8613	2307.1	-0.	2200.0	2.7374	1302.4	-0.	2384.1	6.6309	66.665	-0.
96.000	1.1000	60272	295.28	4.1070	1547.6	-0.	443.84	6.1820	790.22	-0.	908.40	10.008	73.911	-0.
97.000	1.1000	87574	238.21	2.8785	1192.9	-0.	283.81	2.1126	950.47	-0.	344.31	4.5884	123.97	-0.
98.000	1.1000	66812	354.46	4.8400	793.34	-0.	515.31	2.3892	1899.9	-0.	965.54	12.560	91.764	-0.
99.000	1.1000	97500	167.97	1.9189	1682.2	-0.	260.31	5.3094	339.41	-0.	328.49	7.5845	95.918	-0.
100.00	1.1000	1.22000E+05	292.75	3.2181	1320.7	-0.	299.89	1.8969	1016.7	-0.	406.61	8.2271	162.95	-0.
101.00	1.1000	69857	158.04	1.6604	1677.7	-0.	90.340	.32415	1062.6	-0.	95.949	.12301	433.56	-0.
102.00	1.1000	1.01195E+05	311.32	2.8743	1355.3	-0.	428.50	2.6970	899.63	-0.	342.90	2.2714	189.65	-0.
103.00	1.1000	78131	178.92	3.1819	1091.2	-0.	207.20	3.8275	528.10	-0.	198.70	3.6682	58.349	-0.
104.00	1.1000	97042	258.06	1.3814	2634.2	-0.	460.84	3.9937	1285.5	-0.	648.11	5.0288	94.874	-0.
105.00	1.1000	80867	309.24	8.8396	201.42	-0.	244.22	5.0789	280.06	-0.	232.75	2.6346	96.106	-0.
106.00	1.1000	1.15853E+05	194.75	5.5293	379.85	-0.	280.42	5.0946	245.27	-0.	857.32	11.756	74.611	-0.
107.00	1.1000	73915	196.16	3.7167	1646.4	-0.	306.39	4.6800	895.43	-0.	306.39	7.1657	109.22	-0.
108.00	1.1000	1.01323E+05	322.34	4.7751	884.29	-0.	467.06	5.8933	382.04	-0.	687.07	7.9135	52.100	-0.
109.00	1.1000	74338	821.59	8.9408	335.22	-0.	1256.2	13.357	108.19	-0.	4714.3	8.5475	184.37	-0.
110.00	1.1000	62452	323.32	2.2891	3053.9	-0.	456.50	2.0298	2141.7	-0.	1161.7	11.494	88.469	-0.
111.00	1.1000	1.05215E+05	288.49	2.4626	2830.3	-0.	329.13	.74306	3293.1	-0.	636.40	6.0543	441.78	-0.
112.00	1.1000	54102	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
113.00	1.1000	1.00601E+05	250.96	3.7033	1081.7	-0.	330.04	6.2585	346.19	-0.	638.59	5.4313	86.531	-0.
114.00	1.1000	82669	204.87	1.3814	1368.8	-0.	290.20	.98682	1696.1	-0.	527.63	9.8090	99.065	-0.
115.00	1.1000	65303	219.54	.63994	2676.1	-0.	298.62	1.3328	1653.0	-0.	355.41	9.5150	74.737	-0.
116.00	1.1000	84822	357.42	6.7637	389.71	-0.	344.24	3.3110	751.10	-0.	556.12	7.7293	71.423	-0.
117.00	1.1000	91557	385.65	2.3525	2161.9	1309.7	595.03	2.4200	1667.2	-0.	739.89	8.9841	76.867	-0.
118.00	1.1000	68224	333.75	1.4292	2646.3	2540.0	481.76	2.2887	2186.3	2060.5	4143.2	6.8131	94.748	12.870
119.00	1.1000	1.12877E+05	541.92	3.8424	1114.5	-0.	817.20	5.5034	455.94	-0.	1635.8	5.4273	88.499	-0.
120.00	1.1000	81122	491.45	3.5130	1571.0	1669.3	738.40	4.8849	838.80	690.19	1733.3	8.8406	107.34	12.870
121.00	1.1000	1.11079E+05	343.02	1.1744	2547.9	2493.7	444.16	2.7473	1166.3	992.03	520.91	6.4253	88.593	44.99
122.00	1.1000	86219	267.72	3.2135	1480.1	1390.6	345.05	2.8586	1117.7	992.03	501.64	6.3146	110.43	97.82
123.00	1.1000	12083	125.65	1.5702	2950.0	-0.	271.23	3.5256	1371.6	-0.	1048.1	6.9006	110.86	-0.
124.00	1.1000	45968	305.71	2.3268	1912.6	1764.3	684.68	2.6397	1329.3	1193.0	560.82	7.2083	92.292	57.82
125.00	1.1000	99193	181.88	1.6523	1216.6	1191.9	301.24	1.6217	1199.8	1238.4	411.80	6.4455	113.40	63.86
126.00	1.1000	91917	420.43	3.4618	2541.0	2467.8	602.45	4.2120	2005.4	1875.0	1340.9	9.3934	72.035	32.15
127.00	1.1000	1.24762E+05	340.56	2.2046	2264.3	2087.5	493.93	3.6220	1170.4	1021.8	873.91	1.3326	84.703	32.15
128.00	1.1000	74775	288.29	11.510	115.62	51.407	337.65	7.4609	303.38	204.49	280.85	2.5146	94.020	32.15
129.00	1.1000	1.15382E+05	391.75	9.7664	199.54	128.16	426.76	5.8502	284.10	172.74	442.05	5.5519	95.177	32.15
130.00	1.1000	82434	364.40	9.9932	162.02	83.440	257.91	1.5058	994.04	884.22	341.72	3.7926	275.63	198.1
131.00	1.1000	1.13325E+05	362.64	4.3074	915.45	832.29	539.61	5.1897	388.08	366.79	748.66	9.9213	69.253	19.21
132.00	1.1000	1.30547E+05	436.21	2.0936	2142.6	-0.	553.06	1.3512	2780.9	-0.	894.95	4.3986	227.04	-0.

17

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
133.00	1.1000	1.46069E+05	266.59	2.2609	2311.9	2247.8	392.06	2.4888	2210.1	2157.3	761.05	6.6906	80.635	25.727
134.00	1.1000	1.34644E+05	236.28	2.2782	1921.5	1803.2	366.83	3.8739	1080.0	956.20	676.52	7.1616	94.543	32.152
135.00	1.1000	91146	390.85	1.9869	1773.6	1797.7	433.56	.39497	1505.5	1448.1	719.88	2.6089	106.60	51.407
136.00	1.1000	1.16031E+05	316.93	3.0696	1470.0	1344.4	485.13	4.9966	679.41	536.48	1415.1	10.251	85.533	19.30
137.00	1.1000	1.01313E+05	412.80	4.1123	738.73	662.55	555.28	6.6382	210.56	109.49	4426.8	9.0484	178.76	25.84
138.00	1.1000	1.06730E+05	897.75	9.3123	151.30	70.636	1338.1	10.274	114.36	57.820	2160.7	5.4652	160.60	25.721
139.00	1.1000	72429	971.46	12.158	105.05	6.4821	1299.8	12.154	105.05	6.4821	1767.0	11.587	67.599	6.4821
140.00	1.1000	1.24881E+05	295.56	5.3599	860.15	626.44	305.75	1.3092	2028.4	2024.3	494.11	7.7314	79.254	58.152
141.00	1.1000	84371	884.63	11.410	163.37	69.876	1259.5	10.212	207.89	88.871	1159.6	8.6316	91.502	86.871
142.00	1.1000	1.00030E+05	455.86	1.8710	2314.4	2191.5	635.45	2.9109	1044.3	863.08	659.34	6.4183	88.458	31.827
143.00	1.1000	94054	246.80	.97329	3358.3	3352.5	383.89	2.7575	1747.3	1653.8	1259.4	8.7309	80.470	19.192
144.00	1.1000	1.10165E+05	4713.3	2.8266	704.25	461.57	4374.4	1.4798	1262.8	-0.	4250.6	2.6423	130.81	25.702
145.00	1.1000	-0.	113.94	.34523	2093.3	2034.6	186.42	1.0870	1700.9	1562.0	267.30	2.2325	291.86	184.2
146.00	1.1000	67250	252.50	4.8435	1315.5	1168.3	413.03	6.3207	625.25	505.00	297.02	1.5265	134.59	64.165
147.00	1.1000	78145	314.48	2.7364	1735.5	1641.1	479.00	3.5599	1225.0	1016.6	900.95	8.3554	63.480	19.424
148.00	1.1000	1.18378E+05	142.15	11.967	154.02	103.22	139.27	2.2496	546.85	456.48	123.46	.32712	206.96	148.1
149.00	1.1000	64408	213.55	1.1854	2746.0	3014.9	316.93	2.2397	1778.1	1691.6	401.11	7.2564	90.946	38.69
150.00	1.1000	42153	797.40	1.9157	2305.6	2156.8	1501.5	2.9520	1355.8	1350.6	532.65	5.9233	138.20	83.80
ESTIMATE OF MEAN			382.63	3.4473	1666.4	1379.5	518.19	3.3733	1159.2	971.63	865.30	6.0841	126.80	51.502
ESTIMATE OF STANDARD DEVIATION			450.03	2.6415	864.04	969.60	503.73	2.4449	672.39	654.52	989.25	3.0313	121.93	47.57
DEGREES OF FREEDOM			147	147	147	30	147	147	147	28	146	147	147	29
T VALUE			10.344	15.876	23.463	7.9214	12.515	16.785	20.974	7.9943	10.605	24.417	12.651	5.930

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
1.0000	1.1000	87180	192.72	2.0300	2578.2	-0.	372.11	2.4421	2187.6	-0.	529.88	7.8176	115.59	-0.
1.0000	1.2000	87180	172.76	2.4518	2400.5	-0.	318.54	2.4518	2199.7	-0.	505.53	6.0465	110.13	-0.
2.0000	1.1000	76344	247.40	1.7258	2123.7	-0.	435.62	4.6172	363.07	-0.	1215.6	10.034	88.111	-0.
2.0000	1.2000	76344	244.05	2.5427	1980.0	-0.	411.82	2.7168	1036.9	-0.	1601.3	9.4250	90.912	-0.
3.0000	1.1000	85862	187.69	1.6477	2530.7	-0.	229.06	1.3185	2025.0	-0.	229.06	2.6276	193.56	-0.
3.0000	1.2000	85862	220.59	2.2361	2422.2	-0.	311.77	2.6812	1755.1	-0.	499.65	6.6402	90.037	-0.
4.0000	1.1000	67581	115.04	1.0807	2172.2	-0.	118.89	.21154	1460.1	-0.	242.99	3.8995	93.931	-0.
4.0000	1.2000	67581	99.957	1.0511	2000.9	-0.	101.22	.30007	1387.2	-0.	234.00	6.2989	84.199	-0.
5.0000	1.1000	94980	137.75	2.2719	2612.0	-0.	176.00	2.0102	2142.4	-0.	396.78	4.3907	154.83	-0.
5.0000	1.2000	94980	113.76	10.035	1616.1	-0.	262.97	2.6189	1184.9	-0.	558.67	7.8274	70.674	-0.
6.0000	1.1000	70818	287.17	3.0334	1345.8	-0.	369.70	2.8080	975.67	-0.	719.19	10.492	93.134	-0.
6.0000	1.2000	70818	279.30	5.7245	444.18	-0.	333.63	2.4405	1107.6	-0.	528.77	3.7280	155.91	-0.
7.0000	1.1000	1.21307E+05	506.19	2.3375	2353.2	-0.	937.00	5.6034	941.75	-0.	1764.1	7.8392	98.505	-0.
7.0000	1.2000	1.21307E+05	264.11	2.2007	1901.3	-0.	844.56	5.9778	824.30	-0.	5067.8	7.5374	107.25	-0.
8.0000	1.1000	82302	221.80	4.1636	1362.9	-0.	200.73	1.9082	1278.6	-0.	631.59	4.2819	237.13	-0.
8.0000	1.2000	82302	193.69	4.9977	1169.8	-0.	159.62	.96577	1241.1	-0.	866.42	2.6817	109.51	-0.
9.0000	1.1000	1.20000E+05	360.24	4.6012	1155.8	-0.	538.91	4.3334	807.58	-0.	2135.7	8.2285	180.95	-0.
9.0000	1.2000	1.20000E+05	256.38	4.7207	1120.6	-0.	409.82	3.8811	1040.3	-0.	944.45	5.7481	66.405	-0.
10.000	1.1000	1.12757E+05	198.57	1.5168	1756.3	-0.	269.82	1.5920	1093.5	-0.	404.05	5.8696	115.94	-0.
10.000	1.2000	1.12757E+05	282.23	1.4090	2776.4	-0.	396.36	1.5056	2330.1	-0.	733.85	5.6120	115.29	-0.
11.000	1.1000	87269	256.67	3.2986	1597.9	-0.	288.84	2.4538	1470.8	-0.	330.81	1.5808	366.46	-0.
11.000	1.2000	87269	262.57	3.2505	1719.4	-0.	342.85	3.1094	1537.4	-0.	770.61	6.1092	199.58	-0.
12.000	1.1000	90595	346.32	5.3468	616.61	-0.	480.08	3.2122	967.33	-0.	793.47	11.323	73.419	-0.
12.000	1.2000	90595	281.42	5.4271	591.25	-0.	378.73	3.4814	875.05	-0.	1162.9	11.476	77.627	-0.
13.000	1.1000	1.00788E+05	452.49	4.4821	1163.8	-0.	587.42	5.1223	707.26	-0.	692.64	5.4961	111.40	-0.
13.000	1.2000	1.00788E+05	359.93	4.6368	960.64	-0.	516.67	5.1299	665.43	-0.	686.15	4.8558	85.951	-0.
14.000	1.1000	48842	316.67	6.2878	615.31	-0.	440.40	2.2060	1791.0	-0.	964.59	8.2635	195.48	-0.
14.000	1.2000	48842	451.15	7.7242	348.35	-0.	550.85	2.6293	1880.3	-0.	1162.3	6.0907	185.92	-0.
15.000	1.1000	1.00942E+05	267.36	1.3209	3188.5	-0.	381.52	1.8032	2469.5	-0.	760.06	8.0816	85.421	-0.
15.000	1.2000	1.00942E+05	196.04	1.4665	2947.0	-0.	323.12	2.3243	2122.2	-0.	632.04	8.0295	108.49	-0.
16.000	1.1000	55984	302.77	.65272	2933.7	-0.	487.18	1.1362	2006.0	-0.	509.98	8.3923	83.006	-0.
16.000	1.2000	55984	251.70	.59071	3442.7	-0.	448.70	1.1463	2211.4	-0.	517.20	7.1829	96.419	-0.
17.000	1.1000	1.11175E+05	202.20	4.3930	892.62	-0.	196.98	1.7997	1138.2	-0.	439.47	8.4408	109.80	-0.
17.000	1.2000	1.11175E+05	177.64	2.9454	1385.2	-0.	196.14	.81988	1237.7	-0.	442.45	6.6398	99.914	-0.
18.000	1.1000	71903	205.40	4.0248	1438.5	-0.	255.56	3.8494	1044.5	-0.	270.21	1.2927	799.08	-0.
18.000	1.2000	71903	167.39	3.2424	1055.5	-0.	283.35	4.8058	754.26	-0.	351.46	4.0040	179.11	-0.
19.000	1.1000	84166	302.80	2.1538	2155.0	-0.	412.17	2.6065	1599.9	-0.	676.49	6.5601	175.34	-0.
19.000	1.2000	84166	263.35	1.6997	2748.8	-0.	458.18	2.4208	1786.5	-0.	1903.7	10.294	77.069	-0.
20.000	1.1000	1.01828E+05	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
20.000	1.2000	1.01828E+05	399.22	4.8712	960.96	-0.	643.35	7.3604	332.20	-0.	860.89	10.173	111.19	-0.
21.000	1.1000	80578	315.86	2.4505	1773.0	-0.	398.11	2.6744	1207.3	-0.	714.56	10.670	74.806	-0.
21.000	1.2000	80578	216.45	2.3410	1335.3	-0.	340.48	2.7623	777.44	-0.	457.40	5.8392	138.65	-0.
22.000	1.1000	67838	[illegible]	13.441	93.467	-0.	2054.5	13.441	110.29	-0.	1162.7	9.7575	90.673	-0.
22.000	1.2000	67838	264.72	2.8059	1507.6	-0.	654.04	4.6411	792.08	-0.	664.34	8.4733	81.318	-0.
23.000	1.1000	77921	349.75	2.7688	1946.9	-0.	475.82	1.3508	1759.4	-0.	453.35	6.9240	105.98	-0.
23.000	1.2000	77921	243.07	2.4420	2411.3	-0.	322.70	1.2251	2032.5	-0.	311.80	3.4280	157.21	-0.
24.000	1.1000	1.15660E+05	551.42	4.5642	1002.8	-0.	1170.4	6.0958	509.69	-0.	2043.0	10.342	81.202	-0.
24.000	1.2000	1.15660E+05	272.12	6.2505	688.49	-0.	479.38	8.2815	270.13	-0.	723.30	5.9482	97.599	-0.
25.000	1.1000	55776	319.89	4.8359	801.23	-0.	344.30	1.9606	927.53	-0.	679.91	12.074	63.597	-0.
25.000	1.2000	55776	357.03	3.3543	1467.9	-0.	436.46	1.8717	2198.4	-0.	681.59	8.5007	108.97	-0.
26.000	1.1000	1.64447E+05	401.98	1.3751	1804.1	-0.	780.76	4.0826	1470.2	-0.	1180.9	9.9630	77.154	-0.
26.000	1.2000	1.64447E+05	159.43	1.7997	2523.8	-0.	400.54	4.5849	1137.2	-0.	345.43	3.9187	84.950	-0.
27.000	1.1000	68267	426.51	5.5885	886.90	-0.	573.28	4.3640	985.64	-0.	828.94	7.6722	80.287	-0.
27.000	1.2000	68267	332.10	5.2557	971.56	-0.	390.48	4.2039	1066.5	-0.	622.61	2.6676	200.12	-0.
28.000	1.1000	46470	387.72	3.9507	1360.7	-0.	553.87	3.9507	880.30	-0.	839.20	9.2169	80.061	-0.
28.000	1.2000	46470	273.72	2.9516	1923.5	-0.	459.11	4.3150	922.91	-0.	994.71	9.5555	70.293	-0.
29.000	1.1000	1.04583E+05	171.86	.71908	3404.1	-0.	231.93	.90321	2376.5	-0.	193.61	.72582	89.101	-0.
29.000	1.2000	1.04583E+05	196.23	.73422	3144.9	-0.	244.93	1.0562	2242.0	-0.	335.75	4.7721	46.593	-0.
30.000	1.1000	1.35235E+05	314.10	3.0477	1687.8	-0.	415.75	5.0525	678.02	-0.	396.70	.16606	1105.6	-0.
30.000	1.2000	1.35235E+05	283.87	3.3549	1491.0	-0.	481.53	4.9424	706.01	-0.	840.31	6.2238	91.931	-0.
31.000	1.1000	59516	292.33	4.0668	1507.9	-0.	344.02	2.9345	1573.2	-0.	457.74	4.7195	82.400	-0.
31.000	1.2000	59516	293.72	3.9400	1423.6	-0.	351.05	3.5482	1194.1	-0.	263.24	1.7228	71.879	-0.
32.000	1.1000	90641	330.06	1.0690	3582.7	-0.	471.38	2.5674	1523.6	-0.	559.12	.93705	180.71	-0.
32.000	1.2000	90641	238.47	1.0938	2651.6	-0.	363.06	1.4015	1771.7	-0.	586.65	5.5178	79.392	-0.
33.000	1.1000	1.03281E+05	272.46	3.5964	1553.1	-0.	351.69	2.3599	1577.2	-0.	354.45	2.6310	138.99	-0.
33.000	1.2000	1.03281E+05	268.17	3.5280	1520.8	-0.	357.74	2.8322	1319.0	-0.	437.51	5.0054	91.156	-0.

19

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICAT:S MISSING DATA) RUN DATE ETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
34.000	1.1000	66531	281.50	5.0252	1122.9	-0.	377.26	4.8841	889.37	-0.	257.85	1.1350	113.27	-0.
34.000	1.2000	66531	225.45	4.4368	1188.0	-0.	316.48	3.6123	1167.5	-0.	284.56	2.0071	113.06	-0.
35.000	1.1000	79378	422.02	2.4036	2268.5	-0.	757.93	8.1343	203.34	-0.	2017.9	6.6715	88.925	-0.
35.000	1.2000	79378	231.03	3.0144	1839.2	-0.	615.50	8.7233	159.22	-0.	2487.3	7.3609	72.552	-0.
36.000	1.1000	89988	220.63	.89383	1592.1	-0.	275.69	1.0619	983.56	-0.	427.62	3.1275	104.78	-0.
36.000	1.2000	89988	268.97	1.0639	3033.5	-0.	387.46	1.3849	2056.5	-0.	675.48	6.3823	85.069	-0.
37.000	1.1000	85063	305.21	2.9262	1749.9	-0.	449.51	1.8404	1925.6	-0.	419.14	7.1181	99.032	-0.
37.000	1.2000	85063	234.00	2.5520	1729.8	-0.	279.18	1.0588	1104.6	-0.	283.31	1.5294	96.639	-0.
38.000	1.1000	44184	223.11	1.0595	1579.0	-0.	234.00	1.3949	677.51	-0.	457.20	5.1362	88.226	-0.
38.000	1.2000	44184	334.69	1.4995	2561.7	-0.	491.68	2.0201	1453.4	-0.	643.53	4.6171	102.99	-0.
39.000	1.1000	1.03595E+05	217.47	3.6575	1359.1	-0.	320.22	3.6676	807.25	-0.	418.07	5.6194	52.418	-0.
39.000	1.2000	1.03595E+05	173.06	2.0005	1999.9	-0.	251.75	1.8119	1548.2	-0.	305.39	4.4193	61.127	-0.
40.000	1.1000	87493	1623.7	3.2792	2469.2	-0.	2040.1	5.9966	601.62	-0.	7681.9	6.0373	207.57	-0.
40.000	1.2000	87493	198.72	1.4947	3057.7	2897.0	474.80	3.2092	1473.9	1407.9	2627.9	9.9697	83.256	12.870
41.000	1.1000	81797	509.58	1.8772	1912.5	-0.	604.25	2.9699	865.29	-0.	1425.1	6.0577	87.905	-0.
41.000	1.2000	81797	448.25	3.6186	1943.2	-0.	534.09	2.1046	1520.9	-0.	989.83	4.4855	46.270	-0.
42.000	1.1000	1.43170E+05	487.31	3.9012	1075.1	-0.	735.22	6.1818	419.70	-0.	2405.8	11.598	108.41	-0.
42.000	1.2000	1.43170E+05	295.86	4.2528	928.46	854.10	593.51	6.9067	325.54	242.49	2257.0	11.578	93.790	6.4363
43.000	1.1000	69920	294.59	1.5483	1980.8	-0.	454.79	1.8640	1217.1	-0.	607.15	7.1657	44.200	-0.
43.000	1.2000	69920	257.22	1.5470	1978.6	-0.	469.15	3.0075	839.65	-0.	557.23	6.9188	42.758	-0.
44.000	1.1000	77561	361.84	2.6243	1970.7	-0.	513.77	3.7111	1119.5	-0.	647.97	1.7668	52.788	-0.
44.000	1.2000	77561	284.00	3.4961	1223.7	-0.	493.68	5.5193	469.54	-0.	1106.0	5.4310	70.666	-0.
45.000	1.1000	56809	448.45	3.8921	1240.0	-0.	825.77	5.2942	619.50	-0.	845.99	9.0931	99.450	-0.
45.000	1.2000	56809	345.55	3.0033	1675.4	-0.	512.12	3.4143	1116.6	-0.	709.05	6.3470	91.028	-0.
46.000	1.1000	42406	522.13	3.6452	1777.2	-0.	1031.9	5.6011	886.43	-0.	1607.2	9.8615	98.579	-0.
46.000	1.2000	42406	251.39	3.5008	1650.5	-0.	490.32	5.5864	874.30	-0.	981.43	6.6855	82.979	-0.
47.000	1.1000	81191	429.55	3.1228	1937.1	-0.	579.83	3.5885	874.93	-0.	456.91	3.7671	51.549	-0.
47.000	1.2000	81191	324.95	2.6889	2141.2	-0.	446.61	3.4147	1194.0	-0.	678.31	6.1114	80.971	-0.
48.000	1.1000	91238	320.22	4.6106	684.41	-0.	363.93	4.2893	315.53	-0.	345.55	5.1989	74.258	-0.
48.000	1.2000	91238	312.03	3.4320	1162.9	-0.	445.20	3.7908	587.83	-0.	470.48	6.2008	69.348	-0.
49.000	1.1000	75035	276.55	3.2196	1807.8	-0.	396.94	4.3059	922.20	-0.	318.20	4.5614	88.400	-0.
49.000	1.2000	75035	299.67	3.6243	1804.1	-0.	414.79	5.1619	755.58	-0.	456.18	7.4486	74.362	-0.
50.000	1.1000	63397	204.40	1.3877	3262.8	-0.	258.97	.85054	2159.3	-0.	385.48	3.3142	119.37	-0.
50.000	1.2000	63397	125.41	1.6685	2347.0	-0.	172.46	1.2775	917.02	-0.	366.87	7.8810	69.908	-0.
51.000	1.1000	37426	144.39	1.5322	1458.7	-0.	144.39	1.1597	959.64	-0.	141.70	1.4632	60.955	-0.
51.000	1.2000	37426	167.44	2.2640	1835.4	-0.	210.58	1.9901	1581.2	-0.	545.77	4.7716	160.02	-0.
52.000	1.1000	51834	378.44	8.4512	286.27	-0.	342.00	1.7238	1490.6	-0.	581.05	7.4424	48.948	-0.
52.000	1.2000	51834	261.93	7.8167	254.73	-0.	208.17	1.0848	1469.8	-0.	1119.7	8.7294	63.667	-0.
53.000	1.1000	31440	229.97	1.6659	2906.2	-0.	363.78	6.4469	332.69	-0.	498.61	6.4182	57.911	-0.
53.000	1.2000	31440	117.06	1.7095	2322.2	-0.	348.99	5.3314	468.24	-0.	635.68	3.2858	52.052	-0.
54.000	1.1000	78654	291.58	3.9749	1486.6	-0.	414.54	4.5088	1021.1	-0.	721.50	7.2878	82.863	-0.
54.000	1.2000	78654	224.14	3.3762	1307.2	-0.	335.44	4.1641	1029.2	-0.	502.37	4.4113	86.519	-0.
55.000	1.1000	51257	284.00	2.7165	2374.8	-0.	353.86	1.8948	2080.4	-0.	567.53	3.1405	163.01	-0.
55.000	1.2000	51257	184.13	1.2196	3288.6	-0.	294.00	1.8658	1610.5	-0.	475.84	3.4577	122.20	-0.
56.000	1.1000	46581	212.11	.75745	3350.0	-0.	282.20	1.1526	1882.2	-0.	228.51	3.2012	90.056	-0.
56.000	1.2000	46581	207.77	.43220	3385.2	-0.	292.10	.95265	1626.0	-0.	458.14	4.2022	95.565	-0.
57.000	1.1000	1.02100E+05	125.96	.99063	1591.7	-0.	200.43	1.3692	830.23	-0.	285.81	5.1045	112.95	-0.
57.000	1.2000	1.02100E+05	149.12	1.3313	2097.6	-0.	272.97	1.9930	1470.6	-0.	530.79	7.1727	106.27	-0.
58.000	1.1000	58749	327.20	1.8532	2387.7	-0.	483.71	2.0912	1316.6	-0.	1242.7	7.7261	76.318	-0.
58.000	1.2000	58749	175.77	.62962	2436.0	-0.	304.61	.62962	1537.9	-0.	515.67	3.9012	96.168	-0.
59.000	1.1000	93991	306.42	2.9375	1853.5	-0.	425.17	.35482	1302.8	-0.	587.26	6.0665	120.73	-0.
59.000	1.2000	93991	210.36	3.4545	1812.6	-0.	321.92	.50162	2029.7	-0.	390.69	5.6122	88.571	-0.
60.000	1.1000	94160	280.54	2.9678	2010.3	-0.	350.52	2.5284	1358.4	-0.	-0.	2.4435	127.80	-0.
60.000	1.2000	94160	212.29	3.0096	1483.1	-0.	328.32	2.8040	571.73	-0.	385.31	3.7627	90.300	-0.
61.000	1.1000	1.05829E+05	271.42	7.6498	237.85	-0.	403.11	6.9134	280.01	-0.	475.45	5.4489	66.750	-0.
61.000	1.2000	1.05829E+05	183.17	6.6704	452.69	-0.	236.65	4.8964	455.92	-0.	147.86	.60778	92.323	-0.
62.000	1.1000	1.00769E+05	441.66	6.6461	454.58	-0.	556.25	6.1137	396.52	-0.	699.48	6.2397	110.54	-0.
62.000	1.2000	1.00769E+05	322.53	6.6524	480.32	-0.	508.09	5.2321	570.76	-0.	743.67	7.4896	97.054	-0.
63.000	1.1000	63691	255.90	.91846	2974.0	-0.	419.97	.92529	3013.4	-0.	823.81	9.9052	63.757	-0.
63.000	1.2000	63691	202.57	1.0877	2779.0	-0.	301.70	1.0666	2582.0	-0.	363.85	3.9836	100.66	-0.
64.000	1.1000	31477	383.34	3.9147	638.85	-0.	639.64	6.6010	225.61	-0.	600.67	3.9869	[illegible]	-0.
64.000	1.2000	31477	252.17	7.3866	301.13	-0.	457.55	5.2628	497.91	-0.	536.62	8.6358	102.61	-0.
65.000	1.1000	54957	225.35	1.6414	2667.5	-0.	421.90	5.6750	561.31	-0.	479.17	6.8350	103.72	-0.
65.000	1.2000	54957	123.39	.35969	3764.1	-0.	228.04	.25873	3052.6	-0.	400.13	4.5736	112.14	-0.
66.000	1.1000	97023	271.62	1.6631	2649.0	-0.	402.84	2.7134	1437.7	-0.	637.86	6.5157	130.36	-0.
66.000	1.2000	97023	199.40	1.3272	2995.3	-0.	315.43	2.9305	1318.6	-0.	442.88	4.1989	135.69	-0.

20

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
67.000	1.1000	1.08971E+05	222.79	2.0239	2435.2	-0.	351.70	3.9664	1034.5	-0.	398.81	4.6853	129.91	-0.
67.000	1.2000	1.08971E+05	189.16	2.3000	2427.7	-0.	353.92	4.5951	865.11	-0.	508.69	6.8873	74.993	-0.
68.000	1.1000	71094	454.66	2.8898	2312.5	-0.	633.30	2.3134	1910.9	-0.	1629.7	8.1445	77.371	-0.
68.000	1.2000	71094	494.36	3.6281	1913.4	-0.	793.83	4.0557	1141.0	-0.	1895.1	8.3612	68.499	-0.
69.000	1.1000	1.05137E+05	2091.3	1.7037	1454.8	-0.	2865.8	2.8328	600.14	-0.	3869.5	3.5860	111.96	-0.
69.000	1.2000	1.05137E+05	308.80	3.6008	1287.1	-0.	456.03	3.7203	671.27	-0.	509.05	5.0357	70.218	-0.
70.000	1.1000	40045	294.28	.99104	2526.1	-0.	502.61	3.7636	1173.6	-0.	773.53	9.7343	132.29	-0.
70.000	1.2000	40045	160.28	1.7214	1573.9	-0.	513.50	3.0770	1920.6	-0.	603.22	3.7706	76.934	-0.
71.000	1.1000	68214	191.87	.3[illegible]506	3015.0	-0.	236.79	.13506	1788.6	-0.	524.10	6.5809	115.96	-0.
71.000	1.2000	68214	188.25	.[illegible]0170	2851.1	-0.	252.15	.15312	1720.2	-0.	956.88	5.7450	76.752	-0.
72.000	1.1000	84663	251.95	2.5066	1942.8	-0.	240.66	.25374	2615.7	-0.	324.50	2.3708	393.66	-0.
72.000	1.2000	84663	128.07	1.7768	2260.3	-0.	171.96	1.2043	2197.5	-0.	174.72	5.5454	51.582	-0.
73.000	1.1000	31257	269.08	2.5624	1419.8	-0.	375.33	3.5614	880.89	-0.	331.35	7.0551	144.17	-0.
73.000	1.2000	31257	217.30	1.5516	1268.3	-0.	304.35	2.0471	909.29	-0.	217.30	2.6213	49.215	-0.
74.000	1.1000	55115	323.05	2.7592	1955.6	-0.	409.37	2.7947	1385.1	-0.	425.36	2.6100	83.261	-0.
74.000	1.2000	55115	137.84	2.5992	1164.1	-0.	192.96	2.0726	592.31	-0.	227.72	4.1683	73.389	-0.
75.000	1.1000	83993	241.79	2.6573	1308.2	-0.	359.17	1.2912	1484.0	-0.	556.66	5.2304	65.674	-0.
75.000	1.2000	83993	178.26	2.9368	1036.6	-0.	434.10	.84305	1470.6	-0.	1388.0	6.7180	63.756	-0.
76.000	1.1000	77974	183.27	.15223	3560.2	-0.	231.90	.20161	2962.1	-0.	288.68	4.4555	163.21	-0.
76.000	1.2000	77974	161.62	.15205	3880.7	-0.	216.68	.17667	3343.7	-0.	255.59	3.2865	199.01	-0.
77.000	1.1000	74674	227.27	.46787	2110.7	-0.	318.29	2.0512	698.73	-0.	431.53	3.4170	155.01	-0.
77.000	1.2000	74674	283.11	.37628	3462.5	-0.	449.28	1.8198	1711.8	-0.	465.47	.24455	112.99	-0.
78.000	1.1000	1.43520E+05	243.84	8.0512	193.96	-0.	130.77	.13442	1546.6	-0.	211.47	3.5525	60.411	-0.
78.000	1.2000	1.43520E+05	234.70	2.9175	1540.3	-0.	236.09	.62618	1806.7	-0.	360.63	4.8470	46.004	-0.
79.000	1.1000	74612	368.01	6.1145	631.59	-0.	455.25	4.3428	516.87	-0.	795.18	6.5121	67.531	-0.
79.000	1.2000	74612	360.26	5.5947	713.74	-0.	442.89	4.9602	361.74	-0.	674.14	6.4191	60.271	-0.
80.000	1.1000	90502	374.91	6.2292	572.30	-0.	499.49	4.1682	662.84	-0.	569.75	7.6988	117.20	-0.
80.000	1.2000	90502	228.29	5.6396	516.11	-0.	170.57	3.0189	293.87	-0.	125.99	.86601	100.37	-0.
81.000	1.1000	83738	212.70	4.2394	1053.0	-0.	176.62	.76618	1400.2	-0.	267.09	.39864	486.83	-0.
81.000	1.2000	83738	224.45	4.1108	1199.1	-0.	185.17	.69918	1617.5	-0.	241.38	.32223	227.82	-0.
82.000	1.1000	84303	310.58	2.7687	1942.5	-0.	498.88	3.6645	1013.7	-0.	577.48	3.5550	103.57	-0.
82.000	1.2000	84303	274.76	2.7422	1831.6	-0.	406.54	3.2439	1059.6	-0.	481.78	4.1615	97.509	-0.
83.000	1.1000	92826	367.67	.62160	2167.2	-0.	551.72	2.0975	735.97	-0.	1295.1	9.2106	76.212	-0.
83.000	1.2000	92826	231.19	.54273	2229.9	-0.	288.93	1.6146	921.47	-0.	580.64	7.8455	84.509	-0.
84.000	1.1000	89609	278.50	2.5016	2037.9	-0.	426.78	5.1387	790.92	-0.	653.18	11.940	73.649	-0.
84.000	1.2000	89609	261.56	8.7638	263.86	-0.	236.45	2.9186	545.79	-0.	275.57	4.4053	30.751	-0.
85.000	1.1000	29878	289.06	.72233	3465.6	-0.	403.20	1.3922	2513.7	-0.	458.35	6.8560	85.571	-0.
85.000	1.2000	29878	262.09	.82591	3299.5	-0.	410.82	1.1701	2882.1	-0.	619.84	9.5411	70.053	-0.
86.000	1.1000	74530	210.70	1.3533	1530.2	-0.	277.25	.46253	1073.0	-0.	238.91	1.9211	63.533	-0.
86.000	1.2000	74530	202.07	1.3259	2001.1	-0.	335.33	.29071	2323.1	-0.	467.87	4.2413	63.239	-0.
87.000	1.1000	62562	330.62	4.1123	1062.2	-0.	472.21	4.5476	638.48	-0.	571.38	8.6861	63.607	-0.
87.000	1.2000	62562	282.22	4.1301	1009.8	-0.	432.53	4.1408	575.88	-0.	426.61	4.5723	70.466	-0.
88.000	1.1000	84072	254.32	3.0235	1668.5	-0.	314.90	.43034	2498.1	-0.	487.66	7.3481	83.261	-0.
88.000	1.2000	84072	251.12	3.4990	1756.6	-0.	284.83	.89567	2530.0	-0.	528.89	8.8257	88.458	-0.
89.000	1.1000	54185	240.32	3.6659	742.36	-0.	317.33	.93661	1348.8	-0.	292.96	1.9476	45.262	-0.
89.000	1.2000	54185	273.58	4.8605	952.07	-0.	297.79	.98467	2174.8	-0.	551.06	2.7697	419.50	-0.
90.000	1.1000	76195	237.50	1.6161	2114.1	-0.	118.03	.19598	568.04	-0.	82.048	.68357	9.1535	-0.
90.000	1.2000	76195	140.86	1.3108	1162.3	-0.	106.30	.29388	321.25	-0.	96.666	.94630	9.2184	-0.
91.000	1.1000	68864	165.72	.79821	1786.3	-0.	269.30	2.0614	685.24	-0.	363.38	4.4688	79.017	-0.
91.000	1.2000	68864	154.97	1.0256	2245.7	-0.	216.67	1.0395	1240.1	-0.	407.86	4.4648	106.54	-0.
92.000	1.1000	56137	202.93	10.807	150.76	-0.	161.15	5.6974	210.25	-0.	135.38	2.0210	267.38	-0.
92.000	1.2000	56137	134.18	.30252	3383.5	-0.	273.23	1.0579	2395.6	-0.	588.22	4.2892	146.07	-0.
93.000	1.1000	49392	236.08	2.1064	1584.5	-0.	284.66	.64154	1129.2	-0.	276.06	1.5874	108.49	-0.
93.000	1.2000	49392	200.26	2.1036	2150.8	-0.	210.07	.72247	1586.0	-0.	238.20	2.3406	117.20	-0.
94.000	1.1000	81590	427.94	3.1793	1653.9	-0.	613.02	2.9311	1150.5	-0.	1674.7	4.4636	77.392	-0.
94.000	1.2000	81580	253.17	2.2761	2113.6	-0.	451.13	2.9574	1405.8	-0.	1021.7	7.2347	63.830	-0.
95.000	1.1000	63632	1985.7	1.8613	2307.1	-0.	2200.0	2.7374	1302.4	-0.	2384.1	6.6304	66.665	-0.
95.000	1.2000	63632	313.94	2.2702	2517.3	-0.	484.66	4.2941	999.02	-0.	630.50	6.7717	96.110	-0.
96.000	1.1000	60272	295.28	4.1070	1547.6	-0.	443.84	6.1820	790.22	-0.	908.40	10.002	73.911	-0.
96.000	1.2000	60272	224.66	3.8752	1563.0	-0.	317.51	3.9688	1256.4	-0.	468.02	4.9873	93.482	-0.
97.000	1.1000	87574	238.21	2.8785	1192.9	-0.	283.81	2.1126	950.47	-0.	344.31	4.5884	123.97	-0.
97.000	1.2000	87574	230.47	2.7444	1761.6	-0.	396.07	4.2657	1042.0	-0.	760.38	10.934	66.899	-0.
98.000	1.1000	66812	354.46	4.8400	793.34	-0.	515.31	2.3892	1899.9	-0.	965.54	12.560	91.764	-0.
98.000	1.2000	66812	327.48	4.8018	820.25	-0.	370.22	.70385	3047.5	-0.	1174.1	10.944	65.151	-0.
99.000	1.1000	97500	167.97	1.9189	1682.2	-0.	260.31	5.3094	339.41	-0.	328.49	7.5845	95.918	-0.
99.000	1.2000	97500	184.21	1.6645	2205.7	-0.	313.06	4.2628	661.67	-0.	372.06	2.8734	162.03	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
100.00	1.1000	1.22000E+05	292.75	3.2181	1320.7	-0.	299.89	1.8969	1016.7	-0.	406.61	8.2271	162.95	-0.
100.00	1.2000	1.22000E+05	244.33	4.2364	873.07	-0.	231.19	.96876	1170.6	-0.	370.05	6.9923	95.542	-0.
101.00	1.1000	69857	158.04	1.6604	1677.7	-0.	90.340	.32415	1062.6	-0.	95.949	.12301	433.56	-0.
101.00	1.2000	69857	217.90	1.2327	2611.0	-0.	253.43	.44437	2171.4	-0.	492.53	5.5487	113.21	-0.
102.00	1.1000	1.01195E+05	311.32	2.8743	1355.3	-0.	428.50	2.6970	899.63	-0.	342.90	2.2714	189.65	-0.
102.00	1.2000	1.01195E+05	335.02	8.4936	172.38	-0.	435.57	5.2708	247.07	-0.	477.52	3.7036	102.40	-0.
103.00	1.1000	78131	178.92	3.1619	1091.2	-0.	207.20	3.8275	528.10	-0.	198.70	3.6682	58.349	-0.
103.00	1.2000	78131	471.51	3.4212	1745.4	-0.	525.87	3.7164	1277.4	-0.	371.77	3.6167	49.589	-0.
104.00	1.1000	97042	258.06	1.3814	2634.2	-0.	460.84	3.9937	1285.5	-0.	648.11	5.8288	94.874	-0.
104.00	1.2000	97042	206.09	1.1486	2348.9	-0.	414.51	3.7057	1383.9	-0.	1564.5	9.4419	77.388	-0.
105.00	1.1000	80867	309.24	8.8396	201.42	-0.	244.22	5.0789	280.06	-0.	232.75	2.6346	96.106	-0.
105.00	1.2000	80867	346.64	7.5120	412.65	-0.	380.36	5.1224	624.33	-0.	336.42	4.4079	73.738	-0.
106.00	1.1000	1.15850E+05	194.75	5.5293	379.85	-0.	280.42	5.0946	245.27	-0.	857.32	11.756	74.611	-0.
106.00	1.2000	1.15850E+05	243.89	3.6567	1255.1	-0.	543.44	3.4872	799.96	-0.	651.27	8.2143	83.457	-0.
107.00	1.1000	73915	196.16	3.7167	1646.4	-0.	306.39	4.6800	895.43	-0.	306.39	7.1657	109.22	-0.
107.00	1.2000	73915	181.41	3.0659	2047.9	-0.	284.58	3.6621	1187.1	-0.	328.17	6.9529	110.81	-0.
108.00	1.1000	1.01323E+05	322.34	4.7751	884.29	-0.	467.06	5.8933	382.04	-0.	687.07	7.9135	52.100	-0.
108.00	1.2000	1.01323E+05	307.84	4.9076	972.15	-0.	426.33	4.6990	642.01	-0.	523.34	4.8841	62.317	-0.
109.00	1.1000	74338	821.59	8.9408	335.22	-0.	1256.2	13.357	108.19	-0.	4714.3	8.5475	184.37	-0.
109.00	1.2000	74338	580.80	8.6540	272.52	-0.	953.85	12.315	92.686	-0.	1291.0	11.681	86.430	-0.
110.00	1.1000	62452	323.32	2.2891	3053.9	-0.	456.50	2.0298	2141.7	-0.	1161.7	11.494	88.469	-0.
110.00	1.2000	62452	157.81	2.0060	2763.3	-0.	267.54	1.4093	2325.6	-0.	851.07	10.419	78.404	-0.
111.00	1.1000	1.05215E+05	288.49	2.4626	2830.3	-0.	329.13	.74306	3293.1	-0.	636.40	6.0543	441.78	-0.
111.00	1.2000	1.05215E+05	281.69	3.1252	1849.9	-0.	325.25	1.2902	2202.4	-0.	682.39	10.133	80.997	-0.
112.00	1.1000	54102	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
112.00	1.2000	54102	159.46	2.7385	939.24	-0.	179.38	2.4797	633.87	-0.	1471.5	8.1275	77.157	-0.
113.00	1.1000	1.00601E+05	250.96	3.7033	1081.7	-0.	330.04	6.2585	346.19	-0.	638.59	5.4313	86.531	-0.
113.00	1.2000	1.00601E+05	224.83	1.8089	1969.8	-0.	348.22	1.6930	1621.2	-0.	848.04	7.1853	74.649	-0.
114.00	1.1000	82669	204.87	1.3814	1868.8	-0.	290.20	.98682	1696.1	-0.	527.63	9.8090	99.065	-0.
114.00	1.2000	82669	190.78	1.6386	1911.0	-0.	247.79	.91735	1705.1	-0.	351.95	4.7748	125.31	-0.
115.00	1.1000	65303	219.54	.63994	2676.1	-0.	298.62	1.3328	1653.0	-0.	355.41	9.5150	74.737	-0.
115.00	1.2000	65303	241.35	.40574	3604.9	-0.	300.52	.54169	2732.0	-0.	315.05	2.1304	172.65	-0.
116.00	1.1000	84822	357.42	6.7637	389.71	-0.	344.24	3.3110	751.10	-0.	556.12	7.7293	71.423	-0.
116.00	1.2000	84822	387.72	8.3219	341.95	-0.	398.12	5.0538	713.24	-0.	587.23	7.6649	74.561	-0.
117.00	1.1000	91557	385.65	2.3525	2161.9	1309.7	595.03	2.4200	1667.2	-0.	739.89	8.9841	76.867	-0.
117.00	1.2000	91557	322.81	1.6056	2619.8	-0.	512.09	2.5600	1783.9	-0.	554.46	4.9271	119.36	-0.
118.00	1.1000	68224	333.75	1.4292	2646.3	2540.0	481.76	2.2887	2186.3	2060.5	4143.2	6.8131	94.748	12.870
118.00	1.2000	68224	244.42	.99045	2760.6	2384.6	419.34	3.1504	1765.0	1797.7	4828.3	7.5944	104.98	6.4363
119.00	1.1000	1.12877E+05	541.92	3.8424	1114.5	-0.	817.20	5.5034	455.94	-0.	1635.8	5.4273	88.499	-0.
119.00	1.2000	1.12877E+05	313.43	3.6018	1399.9	1110.7	702.82	5.9836	426.19	-0.	1708.0	5.7061	100.02	-0.
120.00	1.1000	81122	491.45	3.5130	1571.0	1669.3	738.40	4.8849	838.80	690.19	1733.3	8.8406	107.34	12.870
120.00	1.2000	81122	319.65	3.2952	1763.4	1641.2	566.42	4.4883	909.98	781.52	935.10	7.0092	60.503	19.300
121.00	1.1000	1.11079E+05	343.02	1.1744	2547.9	2493.7	444.16	2.7473	1166.3	992.03	520.91	6.4253	88.593	44.992
121.00	1.2000	1.11079E+05	246.00	1.3689	2376.7	-0.	374.18	3.1718	926.03	-0.	457.86	5.9120	81.051	-0.
122.00	1.1000	86219	267.72	3.2135	1480.1	1390.6	345.05	2.8586	1117.7	992.03	501.64	6.3146	110.43	57.820
122.00	1.2000	86219	189.47	3.6099	1348.3	-0.	263.04	2.3168	1365.9	-0.	522.67	3.3272	108.12	-0.
123.00	1.1000	12083	125.65	1.5702	2950.0	-0.	271.23	3.5256	1371.6	-0.	1048.1	5.9006	110.86	-0.
123.00	1.2000	12083	104.74	1.8835	2729.1	2677.5	214.51	2.8714	1682.2	1573.4	1206.6	7.6302	62.946	12.870
124.00	1.1000	45968	305.71	2.3268	1912.6	1764.3	484.68	2.6397	1329.3	1193.0	560.82	7.2083	92.292	57.820
124.00	1.2000	45968	368.14	2.8572	1830.7	1825.4	556.80	3.5095	1230.8	1303.9	865.40	8.4222	81.443	19.300
125.00	1.1000	99193	181.88	1.6523	1216.6	1191.5	301.24	1.6217	1199.8	1238.4	411.80	6.4455	113.40	63.869
125.00	1.2000	99193	288.22	.89975	2121.5	1903.2	423.22	.81651	1716.7	1597.8	484.3	3.5754	85.533	51.288
126.00	1.1000	91917	420.43	3.4618	2541.0	2467.8	602.45	4.2120	2005.4	1875.0	1340.5	9.3934	72.035	32.152
126.00	1.2000	91917	319.97	3.2933	1945.9	1819.8	472.62	4.1465	1408.8	-0.	738.87	6.8220	135.20	32.152
127.00	1.1000	1.24762E+05	340.56	2.2046	2264.3	2087.5	493.93	3.6220	1170.4	1021.8	873.91	1.3326	84.703	32.152
127.00	1.2000	1.24762E+05	227.54	2.3941	2069.6	1908.0	400.34	3.9160	969.46	860.13	627.31	8.2383	66.857	19.300
128.00	1.1000	74775	288.29	11.510	115.62	51.407	337.65	7.4609	303.38	204.49	280.65	2.5148	94.020	32.152
128.00	1.2000	74775	144.48	4.5165	919.49	854.10	322.93	8.5216	195.62	160.02	424.38	9.2442	53.882	70.636
129.00	1.1000	1.15382E+05	391.75	9.7664	199.54	128.16	426.76	5.8502	284.10	172.74	442.05	5.5519	55.177	32.152
129.00	1.2000	1.15382E+05	408.69	10.617	163.17	-0.	434.55	7.2447	214.03	-0.	975.02	1.9072	82.139	-0.
130.00	1.1000	82434	364.40	9.9932	162.02	83.440	257.91	1.5058	994.04	884.22	341.72	3.7926	275.63	198.14
130.00	1.2000	82434	417.88	1.9572	2123.3	2231.9	534.37	.27491	3250.0	3139.4	959.27	4.5279	273.37	191.80
131.00	1.1000	1.13325E+05	362.64	4.3074	915.45	832.29	539.61	5.1897	388.08	366.79	748.66	9.9213	69.253	19.217
131.00	1.2000	1.13325E+05	277.86	4.2556	718.87	562.26	429.30	5.2966	369.29	252.86	580.48	8.5862	68.187	12.756
132.00	1.1000	1.30547E+05	436.21	2.0936	2142.6	-0.	553.06	1.3512	2780.9	-0.	894.95	4.3986	227.04	-0.
132.00	1.2000	1.30547E+05	364.17	3.1169	1467.3	1093.0	497.48	1.9818	2064.6	1875.0	686.53	3.7106	197.56	102.62

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
133.00	1.1000	1.46069E+05	266.59	2.2609	2311.9	2247.8	392.06	2.4888	2210.1	2157.3	761.65	6.6906	80.633	25.727
133.00	1.2000	1.46069E+05	203.13	1.9103	2279.8	2168.0	327.95	2.2981	1993.9	1908.0	688.78	7.6093	70.530	32.152
134.00	1.1000	1.34644E+05	236.28	2.2782	1921.5	1803.2	366.83	3.8739	1080.0	956.20	676.52	7.1616	94.943	32.152
134.00	1.2000	1.34644E+05	270.90	2.0161	1717.8	1730.9	395.05	2.2838	1284.0	1181.3	742.15	5.6896	66.453	19.300
135.00	1.1000	91146	390.85	1.9869	1773.6	1797.7	433.56	.39497	1505.5	1448.1	719.88	2.8089	106.60	51.407
135.00	1.2000	91146	194.53	1.8624	2042.4	2025.0	296.74	.66233	2125.4	2003.8	1685.8	.53570	87.555	63.057
136.00	1.1000	1.16031E+05	316.93	3.0696	1470.0	1344.4	485.13	4.9966	679.41	536.48	1415.1	10.251	85.533	19.300
136.00	1.2000	1.16031E+05	301.28	3.6861	1175.4	1104.8	571.16	5.0678	510.48	430.90	1519.6	9.6780	78.868	6.4363
137.00	1.1000	1.01318E+05	412.80	4.1123	738.73	662.55	555.28	6.6382	210.56	109.49	4426.8	9.0484	178.76	25.840
137.00	1.2000	1.01318E+05	330.31	4.1052	838.79	748.42	527.40	6.0889	378.06	300.62	976.88	6.9264	101.54	19.384
138.00	1.1000	1.06730E+05	897.75	9.3123	151.30	70.636	1338.1	10.274	114.36	57.820	2160.7	5.4652	160.60	25.727
138.00	1.2000	1.06730E+05	716.71	9.8111	255.92	147.28	1105.2	10.417	113.08	32.152	3063.2	9.1679	91.390	6.4363
139.00	1.1000	72429	971.46	12.158	105.05	6.4821	1299.8	12.158	105.05	6.4821	1767.6	11.587	67.599	6.4821
139.00	1.2000	72429	500.58	11.264	147.07	102.16	710.64	9.2501	191.21	146.94	749.45	6.5802	91.167	25.668
140.00	1.1000	1.24881E+05	295.56	5.3599	860.15	626.44	305.75	1.3092	2028.8	2024.3	494.11	7.7314	79.254	58.152
140.00	1.2000	1.24881E+05	312.97	4.8131	894.90	-0.	344.26	.81270	1817.7	-0.	870.14	9.7666	51.988	-0.
141.00	1.1000	84371	884.63	11.410	163.37	69.876	1259.5	10.212	207.89	88.871	1159.6	8.4316	91.502	88.871
141.00	1.2000	84371	408.67	8.1347	374.23	257.14	651.88	10.675	166.12	96.986	331.02	1.2449	156.68	96.986
142.00	1.1000	1.00030E+05	455.86	1.8710	2314.4	2191.5	635.45	2.9109	1044.3	863.08	659.34	6.4183	86.458	31.827
142.00	1.2000	1.00030E+05	302.11	2.2021	2170.9	2090.5	434.01	3.8129	774.43	655.94	414.31	6.5599	111.71	58.034
143.00	1.1000	94054	246.80	.97329	3358.3	3352.5	383.89	2.7975	1747.3	1653.8	1259.4	8.7309	80.470	19.192
143.00	1.2000	94054	134.35	.62732	3276.8	-0.	252.71	1.7323	2019.0	-0.	950.48	8.1411	67.103	-0.
144.00	1.1000	1.10165E+05	4713.3	2.8266	704.25	461.57	4374.4	1.4798	1262.8	-0.	4250.6	2.6423	130.81	25.702
144.00	1.2000	1.10165E+05	116.47	2.6178	1817.0	-0.	261.42	5.8934	277.52	-0.	464.05	9.5268	79.643	-0.
145.00	1.1000	-0.	113.94	.34523	2093.3	2034.6	186.42	1.0870	1700.9	1562.0	267.30	2.2325	291.86	184.25
145.00	1.2000	-0.	79.464	.97789	1358.3	1325.5	148.74	1.3608	1221.7	1066.7	229.04	2.3296	156.87	90.110
146.00	1.1000	67250	252.50	4.8435	1315.5	1168.3	413.03	6.3207	625.25	505.00	297.02	1.5265	134.59	64.165
146.00	1.2000	67250	283.62	8.1051	406.90	297.01	394.97	9.0211	206.86	114.53	261.02	5.4886	84.909	19.154
147.00	1.1000	78145	314.48	2.7364	1735.5	1641.1	479.00	3.5599	1225.0	1016.6	900.95	8.3554	63.480	19.424
147.00	1.2000	78145	277.43	2.6541	2006.5	1886.9	443.82	3.0262	1459.6	1279.8	759.09	6.9189	76.297	38.382
148.00	1.1000	1.18378E+05	142.15	11.967	154.02	103.22	139.27	2.2496	546.85	458.48	123.46	.32712	206.96	148.13
148.00	1.2000	1.18378E+05	262.78	2.4188	1930.3	-0.	339.66	1.1665	2094.0	-0.	351.82	.21174	916.44	-0.
149.00	1.1000	64408	213.55	1.1854	2746.0	3014.9	316.93	2.2397	1778.1	1691.6	401.11	7.2564	90.946	38.690
149.00	1.2000	64408	163.12	.64586	3388.1	3223.0	277.69	1.3302	2214.9	2131.2	391.75	5.9402	92.779	51.186
150.00	1.1000	42150	797.40	1.9157	2305.6	2156.8	1581.5	2.9520	1355.8	1350.6	532.65	5.9233	138.20	83.806
150.00	1.2000	42150	881.71	1.7128	1758.6	1615.9	1584.5	2.8202	810.06	891.77	506.63	4.1289	126.93	64.337
ESTIMATE OF MEAN			320.83	3.3360	1712.7	1444.5	455.48	3.2675	1222.2	1007.5	807.70	5.9699	115.09	47.253
ESTIMATE OF STANDARD DEVIATION			331.28	2.4699	867.93	904.98	382.03	2.3729	699.56	723.66	849.15	2.8194	104.85	44.638
DEGREES OF FREEDOM			297	297	297	58	297	297	297	54	296	297	297	56
T VALUE			16.718	23.316	34.065	12.264	20.582	23.770	30.158	10.325	16.392	36.552	18.949	7.9922

23

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
1.0000	2.0000	88630	163.18	2.8229	2313.4	2179.5	266.74	3.6243	1624.3	1538.9	295.19	3.0018	181.66	78.442
2.0000	2.0000	83741	235.93	2.3051	-0.	1945.0	396.96	6.8524	-0.	148.01	1523.0	10.074	-0.	12.937
3.0000	2.0000	88730	256.45	2.7774	2134.6	2006.7	363.67	3.4204	1587.8	1404.8	492.98	7.4846	121.65	45.609
4.0000	2.0000	75600	164.13	2.9223	1592.6	1635.0	187.57	1.8501	968.48	1167.1	254.01	6.1746	-0.	25.761
5.0000	2.0000	1.00078E+05	74.263	.50702	2632.8	2597.1	208.15	2.9333	1212.2	1091.7	598.76	10.191	69.194	6.8029
6.0000	2.0000	72109	226.92	3.4782	1303.4	1131.1	312.22	2.4438	1411.7	1166.6	452.73	3.3823	332.79	180.92
7.0000	2.0000	1.26195E+05	184.63	2.0767	2999.3	2868.5	371.10	5.0076	1307.5	1161.1	2600.0	6.9648	117.31	19.511
8.0000	2.0000	83106	266.14	4.6249	922.70	826.87	254.30	2.4417	765.47	653.35	1351.6	7.8568	62.618	32.804
9.0000	2.0000	1.28439E+05	223.68	2.1583	2516.7	2406.4	335.25	2.9004	1378.8	1267.3	1483.8	4.8920	99.504	26.601
10.000	2.0000	1.14718E+05	200.26	2.3830	2384.3	2240.7	222.47	1.8966	1792.1	1590.4	218.02	1.9360	45.472	13.060
11.000	2.0000	89314	220.69	3.3858	1911.3	1829.6	298.30	3.0517	1792.5	1659.4	726.76	6.1977	233.90	165.40
12.000	2.0000	91312	235.51	4.9032	935.06	760.94	335.22	4.7893	728.13	562.53	528.12	11.312	65.622	13.060
13.000	2.0000	1.03749E+05	342.34	4.5347	1263.5	1131.5	416.80	4.7026	929.52	750.24	469.06	3.1629	125.07	96.302
15.000	2.0000	1.04119E+05	211.71	1.4170	2711.7	-0.	327.36	1.6175	2313.3	-0.	702.06	8.2116	86.076	-0.
16.000	2.0000	60175	185.50	.82452	2791.3	2570.6	274.64	1.6289	1627.0	1663.7	255.21	3.6735	108.94	69.458
17.000	2.0000	1.30000E+05	119.94	1.5085	2336.9	2225.0	134.57	1.2952	1316.2	1205.4	479.07	8.4223	94.640	38.726
18.000	2.0000	73774	144.61	3.5271	1804.5	1721.3	206.49	3.7467	1008.1	841.72	270.58	3.5468	357.29	282.73
19.000	2.0000	85793	235.83	2.9732	1954.1	1791.2	419.55	4.3332	1131.7	985.12	1395.0	10.629	73.211	12.970
20.000	2.0000	1.08932E+05	245.43	1.9257	-0.	2293.0	364.81	3.7907	-0.	909.45	211.58	1.3263	-0.	77.821
21.000	2.0000	85805	186.37	3.0374	-0.	1069.4	238.45	3.6111	-0.	521.10	450.25	5.7203	-0.	72.000
22.000	2.0000	73046	124.39	.35653	-0.	2386.6	268.13	.16052	-0.	3103.8	561.02	6.3220	-0.	61.310
23.000	2.0000	79380	177.68	2.4900	-0.	2219.8	208.59	1.2987	-0.	1669.1	232.26	3.7659	-0.	63.934
24.000	2.0000	1.24116E+05	162.02	2.3302	2484.8	2351.6	281.16	2.6963	1570.6	1467.2	1077.9	10.486	79.960	6.5444
25.000	2.0000	58821	215.02	2.3458	2309.7	2131.8	299.07	1.1497	2438.1	2329.4	474.34	4.7389	140.35	201.31
26.000	2.0000	1.67517E+05	139.66	1.7629	2831.5	2737.8	302.33	4.9400	1250.4	1092.7	380.89	5.3250	84.668	26.725
27.000	2.0000	70757	239.66	4.2460	-0.	1340.2	296.73	2.1694	-0.	1870.1	637.54	3.6456	-0.	119.30
30.000	2.0000	1.41203E+05	365.76	4.1327	-0.	934.81	423.21	4.4340	-0.	560.70	412.86	4.5446	-0.	58.483
31.000	2.0000	62165	265.13	3.8852	1648.6	1561.7	342.19	3.6734	1171.7	1048.4	371.18	3.5747	327.47	32.801
32.000	2.0000	92802	268.13	.59518	4059.9	4063.5	358.95	.48398	3380.1	3208.6	707.00	9.5365	[illegible]	26.432
33.000	2.0000	1.07908E+05	200.60	4.9991	1140.6	1011.6	205.01	1.1041	2679.5	2583.6	376.80	4.8939	77.245	33.153
35.000	2.0000	81749	234.68	2.4654	1904.5	1701.3	410.24	8.6629	87.697	90.412	2035.0	.25648	87.697	13.942
36.000	2.0000	1.10670E+05	219.27	.87607	3545.1	3462.6	369.43	1.3704	2150.4	2070.6	894.42	7.7635	105.02	19.740
37.000	2.0000	88304	169.13	1.7131	2451.4	2389.4	183.83	.95401	1409.3	1318.9	317.92	6.0132	97.657	33.051
38.000	2.0000	45445	204.90	1.7743	2662.5	2621.1	319.40	2.5624	1425.6	1332.4	733.38	6.3384	67.973	13.302
39.000	2.0000	1.10818E+05	203.63	2.7056	1997.3	1857.6	419.50	2.7317	1324.9	1160.3	1086.9	3.5478	150.00	79.663
40.000	2.0000	91579	195.29	2.6756	2863.7	2781.0	328.43	3.9283	1230.6	1450.3	2665.0	7.4176	97.193	19.876
41.000	2.0000	-0.	160.36	5.9167	929.08	801.17	240.78	3.1818	1459.5	1361.9	481.33	6.2055	78.693	33.094
42.000	2.0000	1.48331E+05	292.92	3.9338	1111.8	926.53	417.00	6.0356	323.71	213.02	1146.8	11.248	80.279	20.738
43.000	2.0000	71180	232.21	1.9070	2098.0	1968.6	378.83	2.5046	1378.5	1295.1	682.67	10.246	58.629	13.343
44.000	2.0000	80077	316.41	3.1744	1523.0	1365.3	387.73	3.2393	572.04	456.49	1665.0	6.7381	88.240	6.6416
45.000	2.0000	64605	341.65	2.9003	1820.7	1678.6	469.21	3.6722	1169.9	1019.3	694.50	7.7312	79.341	40.066
46.000	2.0000	48371	265.80	3.6524	2201.5	2083.3	549.77	6.3920	782.44	638.69	1719.0	9.1746	83.127	6.6864
47.000	2.0000	84687	344.69	2.5824	2472.2	1870.1	493.08	3.7938	1108.9	886.34	1011.1	9.6141	75.430	19.975
48.000	2.0000	1.05200E+05	313.35	3.7302	151[illegible].2	1360.9	424.98	4.0244	1072.0	950.19	650.39	6.9339	104.41	52.659
49.000	2.0000	80257	272.21	4.0034	1765.9	1660.3	396.70	4.9894	895.49	806.80	520.85	8.9650	104.89	58.041
50.000	2.0000	64687	138.62	1.2784	3366.6	-0.	206.27	.86791	2407.7	-0.	493.07	7.3936	70.411	-0.
51.000	2.0000	42433	225.63	2.5755	1873.6	-0.	358.52	3.6528	1179.0	-0.	862.33	8.1919	95.578	-0.
52.000	2.0000	52863	335.55	7.5629	345.52	-0.	264.42	.81977	1815.5	-0.	708.58	7.2673	117.17	-0.
53.000	2.0000	31446	125.29	2.5862	1845.1	1734.8	260.88	5.7828	529.48	396.35	756.37	6.0677	75.882	13.201
55.000	2.0000	53137	153.03	1.1287	3316.7	3226.3	243.01	1.4047	2010.5	1061.1	546.96	5.2880	105.32	65.445
56.000	2.0000	49482	159.86	.54008	3690.2	3650.7	258.58	1.2575	2749.6	2732.4	395.51	5.3265	114.18	65.072
57.000	2.0000	1.06348E+05	89.000	.58530	2306.1	2275.7	109.29	.71741	1340.5	1338.8	299.79	4.9108	136.30	97.063
58.000	2.0000	63372	192.39	.67885	3371.1	3273.4	383.89	2.6114	1511.3	1378.3	890.69	9.3330	97.774	32.805
59.000	2.0000	99858	191.20	3.0555	2240.9	2106.1	177.96	.24082	2428.8	2339.2	308.81	3.8962	118.48	71.542
60.000	2.0000	96759	182.37	3.4396	1431.2	-0.	298.29	3.1846	1054.4	-0.	542.25	9.7657	84.858	-0.
61.000	2.0000	1.08501E+05	153.26	6.0837	552.75	487.34	197.40	3.8066	827.84	736.31	153.26	.17084	221.08	162.38
63.000	2.0000	66373	164.24	.56712	670.92	2873.2	325.88	1.1452	2740.5	2688.9	446.00	7.2163	99.832	58.802
65.000	2.0000	68303	100.26	.35589	3759.4	3663.7	173.02	.17582	2926.6	2880.3	312.36	3.3668	130.35	91.011
66.000	2.0000	98317	153.08	.79582	3242.4	3153.3	236.35	1.6111	1790.8	1701.6	523.17	6.2961	107.57	65.154
67.000	2.0000	1.11737E+05	161.59	2.1965	2582.4	2541.0	285.51	3.7846	1441.6	1370.9	435.43	5.2208	117.54	78.196
70.000	2.0000	41951	154.02	1.6631	1850.5	1761.2	248.19	3.4129	1264.0	1155.1	492.30	3.8796	88.071	26.150
71.000	2.0000	71767	131.68	.76922	1815.6	1738.8	168.80	.23540	1109.5	1035.6	573.37	4.8415	85.580	32.680
72.000	2.0000	86501	181.53	2.0239	2335.6	2227.3	247.81	1.4138	2126.2	2125.4	314.87	4.1954	109.62	104.36
73.000	2.0000	35568	242.26	1.9789	1886.5	1792.4	331.90	3.5494	783.26	723.49	353.03	6.0887	97.995	64.091
74.000	2.0000	59746	255.40	3.8783	1639.2	1539.7	392.19	4.7445	769.32	690.08	436.98	7.1819	99.532	57.937
75.000	2.0000	84668	201.12	3.5372	826.51	730.27	426.51	2.6164	1083.2	974.22	2076.0	8.9840	-0.	239.64

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	[illegible] D3	NOXP D3
76.000	2.0000	-0.	178.23	.15350	3824.2	3787.8	240.40	.19062	2992.6	2973.8	228.51	1.3489	187.92	149.87
77.000	2.0000	77373	339.52	.95769	3614.9	3620.5	474.43	3.3762	1178.1	1088.8	327.41	6.1605	76.712	38.775
78.000	2.0000	1.44781E+05	258.41	2.2404	2066.9	2029.0	268.93	.19102	2586.7	2584.8	399.89	5.1752	72.367	13.195
80.000	2.0000	92540	196.57	4.5759	786.36	713.17	199.56	4.1146	557.43	482.07	211.52	1.8704	213.38	182.11
82.000	2.0000	88023	249.23	2.1002	2560.0	2471.0	362.12	2.5987	1710.8	1681.6	497.52	3.3010	174.17	122.56
83.000	2.0000	95321	224.73	.76786	2293.7	2252.0	290.19	2.1085	1026.2	755.19	485.06	8.4742	121.88	45.337
84.000	2.0000	91958	127.74	2.2026	2563.3	2477.8	224.38	4.8180	1097.2	1037.6	387.69	5.2956	127.39	70.740
85.000	2.0000	30396	243.99	.57950	3699.9	3796.4	373.07	1.3090	3025.2	2838.5	566.40	9.8214	79.392	21.757
87.000	2.0000	65976	263.52	3.4766	1354.9	1226.3	390.44	3.8472	844.29	714.28	455.18	6.2168	101.16	51.174
88.000	2.0000	86917	235.22	3.1913	1961.3	1778.7	238.14	.60504	2973.7	2804.1	416.88	3.9573	305.78	234.56
89.000	2.0000	59474	226.44	1.7539	2076.1	1953.9	343.46	.94688	2422.3	2380.4	795.51	4.1378	208.77	158.42
90.000	2.0000	78804	237.77	1.7819	2541.7	2446.2	318.73	1.2101	2553.3	2446.2	461.89	8.1055	65.155	36.510
91.000	2.0000	72402	347.09	7.5070	430.81	304.61	468.43	8.4065	262.84	153.02	477.75	6.0041	181.85	90.592
92.000	2.0000	57231	199.73	.49769	3456.5	3278.4	343.20	1.6039	2073.8	1872.8	539.85	2.2244	448.56	347.07
93.000	2.0000	53806	152.89	1.8726	2296.2	2186.8	164.41	.57673	1731.1	1614.6	296.41	2.8682	114.87	79.425
94.000	2.0000	86282	238.11	2.6078	2231.7	2016.1	403.69	3.9847	1176.1	999.44	1578.0	10.901	99.647	21.585
95.000	2.0000	65141	312.30	2.5081	2312.5	2160.3	512.74	4.7650	844.18	713.37	841.68	10.154	72.084	21.517
96.000	2.0000	64365	199.63	4.3998	1394.6	1282.2	302.39	5.1149	964.60	850.68	318.50	2.1612	112.87	94.781
97.000	2.0000	91822	193.95	1.9574	2494.0	2410.2	281.23	1.6735	2638.7	2592.1	516.78	10.933	80.559	29.806
98.000	2.0000	68483	206.78	.18063	3987.5	3875.1	419.10	1.4325	2306.5	2195.1	1280.8	12.271	78.269	21.861
99.000	2.0000	1.02599E+05	1705.0	.00086	2165.3	2049.0	2118.0	3.0002	1030.5	932.51	1805.0	4.8511	91.079	36.520
100.00	2.0000	1.30673E+05	178.11	1.5412	2272.4	2146.3	211.29	.70769	1562.3	1456.1	331.34	5.7595	120.04	65.817
101.00	2.0000	72082	241.56	1.0427	3053.0	2937.7	266.55	.17459	2539.8	2368.6	452.08	3.6642	160.61	96.084
102.00	2.0000	1.04176E+05	252.65	2.3683	1468.6	1368.3	418.15	4.0778	550.48	450.61	451.28	6.2915	75.882	29.510
103.00	2.0000	82716	338.76	3.1534	2015.7	1864.1	439.55	3.9345	1260.8	1137.9	438.04	8.2959	88.861	29.070
104.00	2.0000	1.00200E+05	273.85	1.2944	3072.7	2818.9	405.96	2.9488	2169.5	2054.6	1619.0	8.7686	94.265	29.566
105.00	2.0000	85003	283.28	7.5717	392.32	299.97	302.33	5.2459	488.09	386.56	270.13	3.9514	79.561	29.544
107.00	2.0000	76583	167.94	3.3974	2232.4	2118.6	248.20	4.1062	1183.1	1056.4	337.07	7.4097	326.00	58.129
108.00	2.0000	1.03655E+05	225.53	4.9741	959.40	789.40	272.28	3.5057	536.96	396.36	369.80	3.7734	85.285	13.833
109.00	2.0000	77638	347.72	5.8728	753.93	620.68	453.23	7.1021	329.74	306.77	386.66	5.9816	48.495	21.619
110.00	2.0000	63022	200.03	1.9729	3197.4	3072.8	289.00	1.5695	2483.5	2326.4	753.43	9.2690	100.17	64.150
113.00	2.0000	1.03396E+05	1725.0	1.8442	1629.1	1397.8	2986.0	1.3520	1815.3	1621.1	2978.0	4.0871	144.01	36.703
114.00	2.0000	85992	184.12	.99177	2116.1	1980.4	242.10	.84873	1904.2	1741.1	386.97	6.3789	111.45	43.661
115.00	2.0000	87724	241.46	.64276	3825.6	3899.1	306.40	1.3233	2580.1	2570.5	321.52	2.8614	210.49	167.16
117.00	2.0000	92722	264.27	1.3950	2704.9	2491.6	396.40	1.5362	2183.7	1944.9	467.36	5.5008	102.60	35.310
118.00	2.0000	71629	237.16	.80802	4107.5	3933.2	364.59	3.5989	1992.2	1805.8	3253.0	7.6738	86.480	14.073
119.00	2.0000	1.17667E+05	264.49	2.8942	2146.3	1767.2	408.27	5.8169	390.02	300.63	2433.0	4.2582	87.683	27.566
120.00	2.0000	85087	326.86	2.8819	2197.7	2036.0	551.42	4.6123	1044.8	869.10	1037.7	7.7023	76.344	13.846
121.00	2.0000	1.13760E+05	6750.0	.87858	1323.5	915.27	6150.0	1.3558	300.49	104.35	6500.6	3.2889	133.85	13.951
124.00	2.0000	49086	358.31	1.8749	2524.3	2363.6	542.66	2.7096	1416.3	1882.2	739.36	7.8032	73.095	20.738
125.00	2.0000	1.03606E+05	144.45	.35921	2666.0	2490.6	212.77	.37213	1410.2	1206.8	1110.1	3.7980	98.897	27.294
126.00	2.0000	95194	332.42	2.7500	1597.0	1406.6	435.08	3.0645	983.16	792.66	737.74	3.9079	131.82	48.558
127.00	2.0000	1.26780E+05	253.16	2.3069	2088.1	-0.	429.09	4.6823	732.24	-0.	386.15	6.7633	81.631	-0.
128.00	2.0000	76099	204.03	5.1663	894.41	749.72	346.55	7.2654	299.46	208.00	568.10	8.5555	82.509	27.887
130.00	2.0000	84486	783.78	10.586	199.92	109.51	699.34	2.6416	1403.4	1169.5	1173.9	11.662	75.736	13.730
131.00	2.0000	1.16373E+05	225.88	3.9278	1037.2	877.10	304.11	4.0747	583.98	444.96	403.35	8.7080	87.801	20.504
132.00	2.0000	1.35298E+05	371.69	1.8838	2171.5	1987.8	519.20	1.9875	2373.5	2154.6	1188.7	9.3188	85.390	27.605
133.00	2.0000	1.47054E+05	273.25	2.1744	2544.7	2336.0	420.10	2.9974	2059.2	1877.1	863.48	8.4065	82.732	13.711
134.00	2.0000	1.36043E+05	232.22	1.8016	1820.7	1646.4	347.20	2.4721	1246.2	1067.3	530.21	4.9261	90.106	14.052
135.00	2.0000	94107	129.30	.89562	1515.2	1298.7	192.78	.83341	1098.7	943.75	185.37	1.0428	64.753	20.828
136.00	2.0000	1.20503E+05	256.95	3.6580	1254.2	1090.4	469.17	4.9047	584.65	448.16	1478.0	9.6404	86.525	6.8861
137.00	2.0000	1.03689E+05	208.29	1.6728	1595.2	1381.4	288.29	3.2716	393.32	308.29	356.38	5.1057	73.981	27.645
139.00	2.0000	74141	530.94	11.807	109.56	55.972	682.23	9.7251	138.99	69.936	825.85	9.2936	71.684	14.011
140.00	2.0000	1.26326E+05	244.96	4.1676	1075.7	933.55	293.06	2.4438	882.72	757.93	407.33	7.8338	59.073	14.222
141.00	2.0000	88147	189.82	3.6125	747.31	649.53	227.02	3.5629	390.41	318.18	317.25	4.4547	13.899	20.504
142.00	2.0000	1.02391E+05	259.58	1.4744	2572.8	2488.0	412.45	3.5600	727.25	634.22	559.68	8.3069	53.617	21.074
143.00	2.0000	95336	279.04	.74606	3517.6	3375.4	371.99	1.0565	2335.4	2182.5	1196.7	7.9178	73.782	27.725
145.00	2.0000	88003	68.372	.71480	1375.7	1273.9	81.554	.16147	887.12	794.36	150.87	.37150	399.08	326.63
146.00	2.0000	71849	280.09	5.2286	1020.2	919.30	435.09	7.0419	343.65	264.19	350.32	6.2210	85.621	35.005
147.00	2.0000	83262	319.84	2.6154	1946.3	1824.7	464.06	3.6525	1100.9	977.08	622.87	4.9495	50.505	20.708
148.00	2.0000	1.20819E+05	208.38	2.0766	2723.8	2565.1	252.71	.81822	3056.3	2879.1	263.11	.17432	480.83	404.56
149.00	2.0000	65576	193.43	.71480	3483.2	3709.5	283.45	1.8732	2034.2	2134.9	353.40	5.0337	812.36	48.488

25

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CHC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE ETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
ESTIMATE OF MEAN			304.12	2.6296	2107.9	1995.1	409.71	2.9515	1433.5	1315.8	769.55	6.1662	115.66	61.618
ESTIMATE OF STANDARD DEVIATION			609.28	1.9101	915.25	909.85	593.62	1.9374	763.40	784.00	778.16	2.7523	74.870	70.893
DEGREES OF FREEDOM			127	127	120	121	127	127	120	121	127	127	118	121
T VALUE			5.6472	15.575	25.334	24.227	7.8085	17.236	20.656	18.537	11.189	25.347	16.852	9.6003

24

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
1.0000	3.0000	89999	165.00	2.2897	2818.5	2748.2	249.99	1.9553	2648.1	2639.0	429.85	7.2673	56.846	35.750
2.0000	3.0000	86470	205.11	1.4024	2498.1	2341.1	337.72	6.5112	217.37	156.15	471.77	7.1186	84.148	28.535
3.0000	3.0000	91070	244.78	2.9990	2159.4	2015.5	380.97	4.2401	1081.1	957.87	543.86	9.5204	75.438	28.833
4.0000	3.0000	78191	160.91	2.7884	-0.	1906.0	119.16	1.0496	-0.	1526.7	266.58	5.4281	-0.	92.623
5.0000	3.0000	1.05920E+05	118.82	.68599	3699.0	3634.0	243.07	3.3600	1461.9	1356.3	870.79	11.202	76.659	21.717
6.0000	3.0000	73165	308.10	1.9621	1671.9	1564.7	359.21	1.7280	1378.2	1290.9	424.90	.40737	148.61	100.50
7.0000	3.0000	1.31641E+05	271.44	2.3904	2563.8	2554.5	496.85	7.7271	449.31	435.11	3750.0	8.9652	106.94	21.746
8.0000	3.0000	84748	222.80	5.3472	856.81	781.77	191.31	2.3226	1100.1	1004.7	303.01	5.6275	95.273	50.752
10.000	3.0000	1.16416E+05	198.44	1.6007	2778.6	2720.4	210.50	1.3615	2103.5	1967.0	210.50	2.4521	33.631	28.910
12.000	3.0000	92110	237.71	3.9759	1281.0	1192.0	268.10	3.2212	674.95	760.82	215.02	4.2093	73.788	28.758
13.000	3.0000	1.06486E+05	361.67	4.5127	1266.7	1190.5	455.99	4.6366	848.93	733.92	477.84	2.7487	127.53	72.444
15.000	3.0000	1.06476E+05	279.29	1.5609	2558.0	2477.9	377.91	2.0278	1873.0	1755.3	462.63	2.6121	101.91	58.222
16.000	3.0000	68803	206.26	.55231	3394.0	3295.1	349.69	1.1861	2326.6	2236.1	380.47	4.6683	108.38	65.130
17.000	3.0000	1.40000E+05	179.82	.90356	2542.6	2492.1	245.48	.43817	3166.5	3083.0	295.21	1.1831	229.05	179.40
18.000	3.0000	75463	27.409	1.2576	2725.5	3018.9	170.58	3.7275	802.73	798.92	222.86	3.0205	301.11	293.30
19.000	3.0000	87794	316.42	3.8039	1598.5	1587.1	966.92	3.7432	1307.4	1203.8	1330.0	8.7186	81.854	21.893
20.000	3.0000	1.13029E+05	252.21	2.2831	2497.3	2463.4	406.32	2.8850	1471.9	1406.1	279.39	4.9548	102.19	58.782
21.000	3.0000	87797	189.68	2.7310	1234.4	1210.2	182.27	1.5515	912.99	883.65	252.27	.61845	195.15	144.49
22.000	3.0000	76298	119.76	.37566	2487.7	2532.5	124.15	.18774	1027.2	978.02	417.36	.69015	217.61	165.48
23.000	3.0000	80075	268.84	2.6819	2276.0	2137.3	317.65	1.6367	1757.2	1653.8	291.67	4.1269	104.51	64.530
25.000	3.0000	62445	187.78	1.5609	3105.3	3066.0	243.18	1.0647	2646.7	2545.0	302.13	3.8556	141.24	106.95
26.000	3.0000	1.73110E+05	132.56	.41394	4331.8	4353.9	305.42	3.3926	1572.5	1544.1	360.44	5.3980	79.419	37.236
27.000	3.0000	73080	250.64	4.2229	1303.4	1271.5	321.61	2.8330	1401.6	1380.8	613.91	3.0259	275.73	235.65
31.000	3.0000	65115	222.88	3.0796	1864.8	1810.2	301.68	3.5658	1047.5	981.82	355.99	3.6837	112.96	86.081
32.000	3.0000	96873	314.19	.87258	3746.1	3767.6	376.65	.42067	2790.5	2855.5	709.20	7.2143	82.957	107.65
33.000	3.0000	1.11996E+05	170.09	1.3811	2961.5	3095.5	224.77	.50841	2704.7	2749.5	448.75	6.5757	71.107	28.720
37.000	3.0000	91120	220.78	1.8671	2704.9	2763.4	315.53	1.4151	2050.1	2114.6	262.64	5.0737	107.37	58.143
38.000	3.0000	46717	202.95	1.1466	2931.5	3035.5	326.18	2.1284	1570.8	1575.4	1178.5	7.2570	76.143	14.444
39.000	3.0000	1.17012E+05	169.60	1.0258	1940.5	1917.4	852.93	.61705	1662.8	1612.0	1240.6	.70879	205.30	149.68
40.000	3.0000	93773	245.17	3.7315	2046.4	2087.0	420.99	4.9277	936.29	869.99	2420.0	10.107	75.840	21.298
43.000	3.0000	72309	253.95	1.2795	2536.8	2480.9	403.61	2.1574	1362.6	1333.2	757.11	10.675	56.684	14.185
44.000	3.0000	82124	332.38	2.8322	1421.8	1377.0	412.08	2.9988	654.68	596.57	948.17	5.5160	67.509	14.368
45.000	3.0000	68788	440.12	4.3016	1260.6	1220.5	650.51	5.5233	515.26	439.31	1701.0	11.420	101.08	21.952
47.000	3.0000	86882	372.76	2.2756	2502.9	2419.4	511.26	3.7794	1097.6	984.44	984.43	9.0959	72.904	21.490
48.000	3.0000	1.15462E+05	335.95	3.8527	1295.4	1258.1	369.68	1.7426	1556.5	1543.5	568.91	6.1520	91.170	42.944
49.000	3.0000	82366	300.42	3.3222	1939.5	1975.5	421.86	4.7785	866.04	836.22	292.91	9.5668	75.942	43.514
50.000	3.0000	66310	209.93	1.3102	2977.1	3122.3	297.22	1.1727	1914.1	2001.2	529.04	6.9405	83.813	35.797
51.000	3.0000	47611	218.33	2.6836	1745.4	1754.2	330.55	3.6531	1127.4	1050.9	720.55	6.5290	134.93	97.024
52.000	3.0000	54007	441.65	6.9248	352.00	305.80	453.88	1.0527	1429.0	1321.2	1432.8	8.1217	92.432	35.937
53.000	3.0000	35440	132.83	2.2555	2056.2	1950.2	324.18	6.6006	304.98	171.14	934.52	6.9308	170.90	21.518
55.000	3.0000	54454	214.06	1.3014	3341.6	3376.1	294.10	1.3160	1845.4	1824.0	597.10	5.0530	176.51	43.283
56.000	3.0000	51963	195.98	.50631	3676.9	3731.3	310.26	1.3730	2498.1	2545.0	439.32	5.6573	109.81	71.963
57.000	3.0000	1.10862E+05	171.86	1.0282	2395.4	2334.9	298.79	1.8353	1734.2	1675.4	560.95	8.7957	92.679	56.500
58.000	3.0000	67898	279.20	1.6005	2500.1	2510.9	513.88	3.0469	1149.3	1088.3	1479.2	9.9033	136.39	21.717
59.000	3.0000	1.03139E+05	242.07	2.6504	2243.0	2236.8	304.15	.77467	2499.7	2493.5	402.35	6.6669	112.36	65.305
60.000	3.0000	99109	163.25	3.0184	1638.5	1670.9	261.58	2.4883	1292.9	1355.2	500.60	9.8338	86.989	43.169
63.000	3.0000	67256	164.73	.73905	2880.5	2771.2	281.14	.97925	2705.1	2578.5	418.32	7.5082	236.18	50.218
65.000	3.0000	77224	111.93	.42719	3910.9	4018.2	197.64	.16672	3004.2	3094.9	310.32	3.5493	126.34	84.976
67.000	3.0000	1.15076E+05	159.81	1.9694	2197.8	2191.0	259.28	2.3615	1942.4	1946.0	618.63	8.7957	150.31	36.079
75.000	3.0000	85065	203.52	2.6641	1305.8	1156.2	475.77	2.4583	1272.9	1097.5	925.49	9.2052	194.04	21.518
ESTIMATE OF MEAN			227.92	2.2470	2327.0	2297.8	350.28	2.5326	1546.2	1501.0	698.60	6.0870	120.81	65.022
ESTIMATE OF STANDARD DEVIATION			81.736	1.3958	850.15	874.29	156.48	1.7447	738.16	749.34	625.97	2.9882	58.864	57.739
DEGREES OF FREEDOM			49	49	48	49	49	49	48	49	49	49	48	49
T VALUE			19.717	11.383	19.161	18.584	15.828	10.264	14.663	14.164	7.8915	14.404	14.366	7.9630

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TEST 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
151.00	68.000	7.0000	3175.0	145.00	225.00	1.0000	1.0000	1.0000	1.0000	4.0000	27640	6.0000
152.00	66.000	3.0000	3970.0	155.00	250.00	2.0000	1.0000	0.	2.0000	4.0000	69774	6.0000
153.00	67.000	3.0000	4010.0	275.00	327.00	6.0000	4.0000	1.0000	2.0000	4.0000	59406	8.0000
154.00	67.000	1.0000	3704.0	260.00	340.00	2.0000	4.0000	1.0000	2.0000	4.0000	59597	8.0000
155.00	67.000	4.0000	4363.0	310.00	425.00	6.0000	2.0000	1.0000	3.0000	4.0000	76017	8.0000
156.00	69.000	9.0000	3485.0	290.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	14416	8.0000
157.00	70.000	3.0000	3863.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	27986	8.0000
158.00	68.000	12.000	2104.0	54.000	91.000	4.0000	1.0000	0.	3.0000	3.0000	26212	4.0000
159.00	70.000	9.0000	4091.0	360.00	429.00	3.0000	4.0000	1.0000	3.0000	4.0000	12793	8.0000
160.00	68.000	3.0000	4005.0	275.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	62835	8.0000
161.00	69.000	12.000	2138.0	53.000	91.000	4.0000	1.0000	1.0000	3.0000	3.0000	4645.0	4.0000
162.00	70.000	3.0000	4198.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	17446	8.0000
163.00	66.000	9.0000	3408.0	315.00	390.00	3.0000	4.0000	1.0000	2.0000	4.0000	77591	8.0000
164.00	67.000	13.000	2220.0	94.000	110.00	7.0000	2.0000	0.	0.	2.0000	63725	4.0000
165.00	70.000	7.0000	3485.0	230.00	318.00	2.0000	2.0000	1.0000	1.0000	4.0000	24665	8.0000
166.00	67.000	2.0000	5028.0	340.00	429.00	6.0000	4.0000	1.0000	3.0000	4.0000	82223	8.0000
167.00	67.000	1.0000	4301.0	220.00	340.00	6.0000	2.0000	1.0000	3.0000	4.0000	52206	8.0000
168.00	68.000	7.0000	4370.0	300.00	383.00	2.0000	4.0000	1.0000	1.0000	4.0000	43086	8.0000
169.00	70.000	5.0000	3834.0	350.00	400.00	6.0000	4.0000	0.	3.0000	4.0000	13102	8.0000
170.00	69.000	5.0000	3972.0	325.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	42559	8.0000
171.00	67.000	7.0000	3660.0	375.00	440.00	2.0000	4.0000	1.0000	3.0000	4.0000	65253	8.0000
172.00	68.000	5.0000	4324.0	290.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	54667	8.0000
173.00	66.000	2.0000	5056.0	340.00	429.00	2.0000	4.0000	1.0000	2.0000	4.0000	46469	8.0000
174.00	69.000	12.000	2108.0	53.000	91.000	4.0000	1.0000	0.	3.0000	3.0000	36438	4.0000
175.00	68.000	11.000	3443.0	128.00	199.00	1.0000	1.0000	1.0000	3.0000	4.0000	54424	6.0000
176.00	68.000	8.0000	4275.0	230.00	318.00	2.0000	2.0000	1.0000	1.0000	4.0000	65164	8.0000
177.00	66.000	3.0000	3810.0	120.00	194.00	2.0000	1.0000	1.0000	2.0000	4.0000	79204	6.0000
178.00	70.000	1.0000	4169.0	370.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	10063	8.0000
179.00	67.000	8.0000	4100.0	230.00	318.00	5.0000	2.0000	1.0000	1.0000	4.0000	34957	8.0000
180.00	66.000	3.0000	3970.0	275.00	327.00	6.0000	4.0000	1.0000	2.0000	4.0000	63085	8.0000
181.00	68.000	2.0000	5166.0	375.00	472.00	6.0000	4.0000	1.0000	2.0000	4.0000	87243	8.0000
182.00	69.000	3.0000	4100.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	21791	8.0000
183.00	68.000	3.0000	4005.0	275.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	45764	8.0000
184.00	68.000	3.0000	4005.0	250.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	80786	8.0000
185.00	70.000	2.0000	5084.0	375.00	472.00	6.0000	4.0000	1.0000	3.0000	4.0000	12158	8.0000
186.00	66.000	3.0000	3820.0	155.00	250.00	2.0000	1.0000	0.	2.0000	4.0000	78988	6.0000
187.00	70.000	9.0000	3100.0	120.00	200.00	2.0000	1.0000	1.0000	3.0000	4.0000	16610	6.0000
188.00	68.000	5.0000	3893.0	335.00	400.00	6.0000	4.0000	0.	3.0000	4.0000	49773	8.0000
189.00	69.000	11.000	3846.0	235.00	343.00	3.0000	2.0000	1.0000	3.0000	4.0000	59909	8.0000
190.00	67.000	9.0000	4000.0	275.00	390.00	3.0000	2.0000	1.0000	2.0000	4.0000	54599	8.0000
191.00	67.000	7.0000	4455.0	350.00	440.00	2.0000	4.0000	1.0000	1.0000	4.0000	51624	8.0000
192.00	69.000	9.0000	4153.0	275.00	390.00	3.0000	2.0000	1.0000	3.0000	4.0000	37268	8.0000
193.00	66.000	9.0000	3151.0	225.00	289.00	3.0000	4.0000	1.0000	2.0000	4.0000	58557	8.0000
194.00	67.000	12.000	2064.0	54.000	91.000	4.0000	1.0000	0.	0.	3.0000	57139	4.0000
195.00	68.000	3.0000	4005.0	250.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	48576	8.0000
196.00	70.000	9.0000	4122.0	270.00	390.00	3.0000	2.0000	1.0000	3.0000	4.0000	22790	8.0000
197.00	67.000	8.0000	4100.0	230.00	318.00	5.0000	2.0000	1.0000	1.0000	4.0000	81907	8.0000
198.00	68.000	12.000	2108.0	54.000	91.000	4.0000	1.0000	0.	3.0000	3.0000	43317	4.0000
199.00	70.000	13.000	2590.0	120.00	113.00	7.0000	2.0000	0.	3.0000	4.0000	36615	4.0000
200.00	67.000	12.000	2108.0	53.000	91.000	4.0000	1.0000	0.	0.	3.0000	55488	4.0000
201.00	69.000	5.0000	3393.0	175.00	250.00	6.0000	1.0000	0.	3.0000	4.0000	55846	8.0000
202.00	67.000	9.0000	2996.0	120.00	200.00	3.0000	1.0000	1.0000	0.	4.0000	61236	6.0000
203.00	67.000	9.0000	4000.0	275.00	390.00	3.0000	2.0000	1.0000	2.0000	4.0000	54778	8.0000
204.00	69.000	1.0000	4418.0	280.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	43855	8.0000
205.00	68.000	8.0000	4050.0	330.00	383.00	1.0000	4.0000	1.0000	1.0000	4.0000	35414	8.0000
206.00	66.000	9.0000	4018.0	265.00	390.00	3.0000	2.0000	1.0000	2.0000	4.0000	23904	8.0000
207.00	67.000	4.0000	4446.0	250.00	330.00	6.0000	2.0000	1.0000	0.	1.0000	47782	8.0000
208.00	68.000	9.0000	3266.0	200.00	289.00	3.0000	2.0000	1.0000	4.0000	4.0000	53563	8.0000
209.00	67.000	4.0000	4713.0	365.00	425.00	6.0000	4.0000	1.0000	2.0000	4.0000	57648	8.0000
210.00	68.000	3.0000	3615.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	59399	8.0000
211.00	68.000	7.0000	3765.0	330.00	383.00	2.0000	4.0000	1.0000	1.0000	4.0000	61258	8.0000
212.00	69.000	9.0000	4987.0	360.00	429.00	3.0000	4.0000	1.0000	4.0000	4.0000	58236	8.0000
213.00	68.000	4.0000	4685.0	365.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	35385	8.0000
214.00	69.000	3.0000	4100.0	303.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	26114	8.0000
215.00	66.000	8.0000	4140.0	230.00	318.00	5.0000	2.0000	1.0000	1.0000	4.0000	60827	8.0000
216.00	68.000	9.0000	4001.0	265.00	390.00	3.0000	2.0000	1.0000	4.0000	4.0000	39573	8.0000

TABLE 1
SUMMARY OF TEST DATA

FLEET Z TEST 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
217.00	70.000	3.0000	4100.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	19097	8.0000
218.00	67.000	5.0000	4504.0	350.00	400.00	2.0000	4.0000	1.0000	2.0000	4.0000	53782	8.0000
219.00	67.000	9.0000	3412.0	275.00	390.00	3.0000	2.0000	1.0000	2.0000	4.0000	51291	8.0000
220.00	70.000	5.0000	3922.0	255.00	350.00	6.0000	2.0000	1.0000	4.0000	4.0000	12724	8.0000
221.00	66.000	9.0000	4418.0	250.00	352.00	3.0000	4.0000	1.0000	2.0000	4.0000	46554	8.0000
222.00	70.000	12.000	2106.0	57.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	12723	4.0000
223.00	68.000	5.0000	4609.0	340.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	34888	8.0000
224.00	67.000	3.0000	3540.0	135.00	283.00	6.0000	2.0000	1.0000	2.0000	4.0000	68569	8.0000
225.00	68.000	5.0000	3561.0	265.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	49476	8.0000
226.00	67.000	5.0000	3561.0	325.00	400.00	6.0000	4.0000	0.	2.0000	4.0000	58888	8.0000
227.00	66.000	3.0000	3970.0	275.00	327.00	6.0000	4.0000	1.0000	2.0000	4.0000	47521	8.0000
228.00	69.000	7.0000	3185.0	145.00	225.00	1.0000	1.0000	1.0000	1.0000	4.0000	31541	6.0000
229.00	70.000	9.0000	4436.0	360.00	429.00	3.0000	4.0000	1.0000	4.0000	4.0000	12811	8.0000
230.00	69.000	3.0000	3320.0	140.00	230.00	6.0000	1.0000	1.0000	3.0000	4.0000	21185	6.0000
231.00	69.000	6.0000	4690.0	350.00	440.00	1.0000	4.0000	1.0000	3.0000	4.0000	25484	8.0000
232.00	69.000	8.0000	3625.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	25137	8.0000
233.00	69.000	10.000	3834.0	250.00	351.00	3.0000	2.0000	1.0000	4.0000	4.0000	54584	8.0000
234.00	67.000	5.0000	3561.0	325.00	400.00	6.0000	4.0000	1.0000	2.0000	4.0000	42787	8.0000
235.00	69.000	1.0000	3819.0	230.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	20301	8.0000
236.00	70.000	3.0000	3734.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	14976	8.0000
237.00	70.000	3.0000	3466.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	19286	8.0000
238.00	68.000	8.0000	4080.0	330.00	383.00	2.0000	4.0000	1.0000	3.0000	4.0000	42111	8.0000
239.00	69.000	3.0000	3435.0	300.00	350.00	6.0000	4.0000	0.	2.0000	4.0000	36397	8.0000
240.00	66.000	12.000	2108.0	50.000	73.000	4.0000	1.0000	0.	0.	3.0000	46474	4.0000
241.00	70.000	9.0000	3398.0	250.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	37325	8.0000
242.00	67.000	9.0000	2996.0	120.00	200.00	3.0000	1.0000	0.	2.0000	4.0000	52910	6.0000
243.00	66.000	5.0000	4088.0	265.00	389.00	6.0000	2.0000	1.0000	2.0000	4.0000	73943	8.0000
244.00	68.000	10.000	4650.0	315.00	390.00	3.0000	4.0000	1.0000	3.0000	4.0000	65233	8.0000
245.00	70.000	7.0000	3315.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	29460	6.0000
246.00	69.000	3.0000	3300.0	155.00	250.00	6.0000	1.0000	0.	2.0000	4.0000	39895	6.0000
247.00	69.000	3.0000	4100.0	335.00	427.00	6.0000	4.0000	1.0000	3.0000	4.0000	48794	8.0000
248.00	68.000	3.0000	4005.0	250.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	56334	8.0000
249.00	66.000	11.000	3656.0	250.00	327.00	1.0000	2.0000	1.0000	2.0000	4.0000	1.02571E+05	8.0000
250.00	68.000	3.0000	4305.0	275.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	24272	8.0000
251.00	69.000	9.0000	3485.0	290.00	351.00	3.0000	4.0000	1.0000	3.0000	4.0000	20003	8.0000
252.00	70.000	12.000	2108.0	57.000	96.600	4.0000	1.0000	0.	3.0000	3.0000	14945	4.0000
253.00	68.000	9.0000	4001.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	64943	8.0000
254.00	69.000	3.0000	4715.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	22610	8.0000
255.00	67.000	3.0000	3210.0	195.00	283.00	6.0000	2.0000	1.0000	2.0000	4.0000	66173	8.0000
256.00	70.000	1.0000	4469.0	260.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	11099	8.0000
257.00	70.000	3.0000	3734.0	350.00	400.00	6.0000	4.0000	0.	3.0000	4.0000	26789	8.0000
258.00	69.000	9.0000	4153.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	26521	8.0000
259.00	66.000	9.0000	3308.0	265.00	390.00	3.0000	2.0000	1.0000	0.	4.0000	81903	8.0000
260.00	66.000	8.0000	3045.0	145.00	235.00	1.0000	1.0000	1.0000	3.0000	4.0000	23524	6.0000
261.00	70.000	1.0000	4354.0	350.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	22861	8.0000
262.00	70.000	5.0000	4948.0	265.00	400.00	6.0000	2.0000	0.	3.0000	4.0000	17020	8.0000
263.00	70.000	11.000	3013.0	155.00	232.00	2.0000	1.0000	0.	3.0000	4.0000	25176	6.0000
264.00	69.000	5.0000	4444.0	265.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	37737	8.0000
265.00	68.000	9.0000	3740.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	51796	8.0000
266.00	67.000	3.0000	2855.0	110.00	164.00	6.0000	2.0000	0.	3.0000	4.0000	56340	6.0000
267.00	67.000	9.0000	3193.0	200.00	289.00	3.0000	2.0000	1.0000	2.0000	4.0000	40072	8.0000
268.00	68.000	9.0000	4726.0	280.00	390.00	3.0000	2.0000	1.0000	3.0000	4.0000	51561	8.0000
269.00	67.000	9.0000	3193.0	200.00	289.00	3.0000	2.0000	1.0000	2.0000	4.0000	42523	8.0000
270.00	69.000	7.0000	3335.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	27635	8.0000
271.00	70.000	4.0000	4736.0	365.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	17345	8.0000
272.00	69.000	8.0000	3600.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	40191	8.0000
273.00	70.000	8.0000	4145.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	15714	8.0000
274.00	66.000	9.0000	3151.0	200.00	289.00	3.0000	2.0000	1.0000	2.0000	4.0000	76117	8.0000
275.00	70.000	9.0000	3558.0	220.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	14183	8.0000
276.00	69.000	12.000	2108.0	53.000	91.000	4.0000	1.0000	0.	3.0000	3.0000	33664	8.0000
277.00	66.000	3.0000	3970.0	275.00	327.00	6.0000	4.0000	1.0000	2.0000	4.0000	76193	8.0000
278.00	67.000	3.0000	4010.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	55179	8.0000
279.00	68.000	1.0000	4705.0	360.00	430.00	6.0000	4.0000	1.0000	3.0000	4.0000	52128	8.0000
280.00	70.000	8.0000	3940.0	330.00	383.00	1.0000	4.0000	1.0000	3.0000	4.0000	30897	8.0000
281.00	66.000	3.0000	3535.0	195.00	283.00	6.0000	2.0000	0.	2.0000	4.0000	55605	8.0000
282.00	68.000	4.0000	4463.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	63299	8.0000

29

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 2 TEST 10

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
283.00	67.000	10.000	4285.0	275.00	390.00	3.0000	2.0000	1.0000	2.0000	4.0000	61965	8.0000
284.00	69.000	10.000	4635.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	28963	8.0000
285.00	69.000	4.0000	4736.0	365.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	21528	8.0000
286.00	66.000	1.0000	4327.0	260.00	340.00	2.0000	4.0000	1.0000	2.0000	4.0000	49323	8.0000
287.00	70.000	10.000	3740.0	250.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	25220	8.0000
288.00	66.000	10.000	3193.0	200.00	289.00	3.0000	2.0000	1.0000	2.0000	4.0000	44070	6.0000
289.00	67.000	3.0000	4010.0	195.00	283.00	6.0000	2.0000	1.0000	2.0000	4.0000	-0.	6.0000
290.00	66.000	1.0000	4616.0	340.00	425.00	6.0000	4.0000	1.0000	2.0000	4.0000	69383	8.0000
291.00	70.000	3.0000	4633.0	250.00	350.00	6.0000	2.0000	0.	3.0000	4.0000	18753	8.0000
292.00	67.000	3.0000	3870.0	275.00	327.00	6.0000	4.0000	1.0000	2.0000	4.0000	55768	8.0000
293.00	66.000	7.0000	3685.0	230.00	318.00	5.0000	2.0000	1.0000	3.0000	4.0000	47310	8.0000
294.00	66.000	7.0000	3130.0	140.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	56745	6.0000
295.00	68.000	6.0000	4375.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	37652	8.0000
296.00	70.000	9.0000	3965.0	300.00	351.00	3.0000	4.0000	1.0000	3.0000	4.0000	23661	8.0000
297.00	68.000	9.0000	3058.0	120.00	200.00	3.0000	1.0000	1.0000	3.0000	4.0000	29228	6.0000
298.00	69.000	4.0000	4464.0	250.00	390.00	6.0000	2.0000	1.0000	3.0000	4.0000	55822	8.0000
299.00	66.000	4.0000	4421.0	310.00	425.00	6.0000	2.0000	1.0000	2.0000	4.0000	90752	8.0000
300.00	70.000	4.0000	3872.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	23585	8.0000
ESTIMATE OF MEAN			3803.6	245.99	325.56	4.2400	2.6333	.82667	2.4733	3.8800	43786	7.4533
ESTIMATE OF STANDARD DEVIATION			700.76	84.966	94.381	1.8160	1.1895	.37990	.89515	.44751	20567	1.1792
DEGREES OF FREEDOM			149	149	149	149	149	149	149	149	148	149
T VALUE			66.477	35.458	42.247	28.596	27.113	26.657	33.843	106.19	25.988	77.415

30

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	[illegible] 7MODE	NOXP 7MODE
151.00	1.1000	7.0000	4.9200	50.180	6.5500	-0.	2.2000	12.580	4.7600	-0.	2.4500	18.310	6.2300	-0.
152.00	1.1000	3.0000	6.9400	83.390	1.7200	-0.	2.1400	34.490	1.5700	-0.	5.8800	79.110	1.3500	-0.
153.00	1.1000	3.0000	6.4000	105.30	8.5000	-0.	5.9600	46.980	5.5900	-0.	5.5500	39.510	8.2600	-0.
154.00	1.1000	1.0000	5.1400	107.49	3.2400	-0.	2.5700	62.840	1.6600	-0.	3.9400	82.330	2.6600	-0.
155.00	1.1000	4.0000	9.9900	129.88	4.2400	-0.	11.310	88.070	2.7600	-0.	12.880	88.520	4.0700	-0.
156.00	1.1000	9.0000	7.0000	73.500	10.930	-0.	3.5700	28.460	7.2400	-0.	4.5600	30.690	10.040	-0.
157.00	1.1000	3.0000	4.3900	29.880	11.510	-0.	2.5600	9.3900	9.2100	-0.	3.1100	9.1190	12.010	-0.
158.00	1.1000	12.000	7.8200	63.260	1.6300	-0.	5.0800	56.410	1.2500	-0.	7.5500	45.620	1.4500	-0.
159.00	1.1000	9.0000	7.2100	103.91	7.8600	-0.	3.1000	63.200	5.5000	-0.	4.2400	73.600	7.6000	-0.
160.00	1.1000	3.0000	11.750	184.50	3.4200	-0.	4.5900	69.420	2.6700	-0.	6.0900	67.370	4.6100	-0.
161.00	1.1000	12.000	4.8700	59.670	6.0400	-0.	2.8700	22.100	5.7400	-0.	4.5200	30.640	6.4000	-0.
162.00	1.1000	3.0000	6.9900	83.530	8.8300	-0.	3.7600	37.780	5.7600	-0.	4.2600	33.610	8.1600	-0.
163.00	1.1000	9.0000	6.7200	94.400	6.2800	-0.	4.5000	56.780	4.1200	-0.	4.6800	52.040	6.1900	-0.
164.00	1.1000	13.000	14.410	117.04	4.1200	-0.	11.370	91.700	1.2100	-0.	14.860	82.860	2.0000	-0.
165.00	1.1000	7.0000	6.5900	96.040	8.7300	-0.	3.8800	53.450	6.0300	-0.	5.1200	57.970	7.0600	-0.
166.00	1.1000	2.0000	14.260	211.78	2.5700	-0.	11.210	141.49	1.5400	-0.	15.010	106.80	4.1300	-0.
167.00	1.1000	1.0000	9.4700	122.75	6.8800	-0.	6.2600	53.450	5.8100	-0.	8.1600	54.920	9.8400	-0.
168.00	1.1000	7.0000	9.1900	170.22	6.2900	-0.	4.5000	56.530	5.0200	-0.	5.4500	73.150	6.5700	-0.
169.00	1.1000	5.0000	10.880	114.29	4.9800	-0.	7.0900	72.320	5.6100	-0.	9.6000	82.390	6.6400	-0.
170.00	1.1000	5.0000	5.6700	66.960	5.0900	-0.	3.8300	28.320	3.6100	-0.	5.6300	30.530	4.4200	-0.
171.00	1.1000	7.0000	11.870	126.50	1.2700	-0.	5.9100	97.880	.54000	-0.	8.8800	107.25	1.3500	-0.
172.00	1.1000	5.0000	6.3800	87.830	7.5000	-0.	3.9400	34.610	6.0800	-0.	4.2300	33.590	7.9500	-0.
173.00	1.1000	2.0000	5.1000	116.75	3.9400	-0.	3.2700	59.870	5.8200	-0.	6.3500	85.620	5.8000	-0.
174.00	1.1000	12.000	8.0500	66.490	4.1000	-0.	3.5600	34.660	4.3700	-0.	5.0000	36.700	4.1000	-0.
175.00	1.1000	11.000	5.9200	94.690	2.8000	-0.	2.6500	40.770	2.9400	-0.	7.1400	106.53	1.6800	-0.
176.00	1.1000	8.0000	7.8500	152.93	4.3300	-0.	3.3500	21.900	7.6900	-0.	4.6500	39.470	8.6500	-0.
177.00	1.1000	3.0000	5.6300	105.51	5.0300	-0.	2.6900	56.250	3.0600	-0.	3.8300	60.650	4.1700	-0.
178.00	1.1000	1.0000	6.4400	106.10	3.4300	-0.	5.2200	90.950	3.0300	-0.	5.6100	79.130	4.7700	-0.
179.00	1.1000	8.0000	6.9400	56.640	15.600	-0.	4.5400	9.4300	12.200	-0.	4.8100	12.200	12.980	-0.
180.00	1.1000	3.0000	6.1200	76.330	7.1000	-0.	3.6800	40.770	4.6000	-0.	4.7500	33.400	8.1000	-0.
181.00	1.1000	2.0000	5.0100	102.37	4.1100	-0.	2.9600	59.100	2.9500	-0.	4.4900	48.300	5.1600	-0.
182.00	1.1000	3.0000	8.9600	142.15	7.0300	-0.	4.5300	53.240	6.5200	-0.	5.6200	48.630	10.390	-0.
183.00	1.1000	3.0000	7.0300	105.94	5.6600	-0.	4.2800	43.860	6.2000	-0.	5.6000	42.570	8.3300	-0.
184.00	1.1000	3.0000	8.5600	155.52	3.5100	-0.	4.8400	78.320	3.2700	-0.	6.0100	60.810	6.4000	-0.
185.00	1.1000	2.0000	4.9300	98.580	7.4200	-0.	3.0200	37.490	6.2700	-0.	3.7400	33.350	9.1300	-0.
186.00	1.1000	3.0000	4.2200	62.500	5.2400	-0.	1.6900	34.380	3.1200	-0.	2.2700	36.390	5.3700	-0.
187.00	1.1000	9.0000	4.4900	43.190	9.0200	-0.	2.9700	18.740	6.7400	-0.	3.6900	15.160	8.4100	-0.
188.00	1.1000	5.0000	13.600	109.03	4.5200	-0.	10.080	68.780	4.9500	-0.	16.680	72.810	5.0800	-0.
189.00	1.1000	11.000	5.6200	76.130	9.4600	-0.	3.4900	28.080	5.6700	-0.	3.7400	30.270	7.5300	-0.
190.00	1.1000	9.0000	6.2800	98.830	7.1600	-0.	4.5000	68.480	4.8500	-0.	6.2500	78.540	6.2100	-0.
191.00	1.1000	7.0000	8.5000	115.00	12.850	-0.	6.7100	90.270	6.6300	-0.	6.9100	96.670	9.7200	-0.
192.00	1.1000	9.0000	6.8300	59.460	9.7700	-0.	3.8100	15.580	8.4000	-0.	4.4100	15.120	8.0500	-0.
193.00	1.1000	9.0000	8.4500	85.240	7.0100	-0.	5.7900	49.750	3.9800	-0.	7.2800	54.320	5.9100	-0.
194.00	1.1000	12.000	7.2800	78.950	3.1000	-0.	4.9300	50.040	1.9100	-0.	7.1300	51.590	2.5700	-0.
195.00	1.1000	3.0000	8.6000	88.800	6.0400	-0.	6.2200	21.850	4.7500	-0.	6.5700	30.300	6.1700	-0.
196.00	1.1000	9.0000	7.1200	116.56	4.7800	-0.	1.8100	17.870	4.0800	-0.	2.6600	23.130	5.7300	-0.
197.00	1.1000	8.0000	19.580	307.94	2.1100	-0.	8.3900	141.70	1.7500	-0.	12.890	179.61	1.9900	-0.
198.00	1.1000	12.000	5.2100	63.750	3.6300	-0.	3.2500	34.780	2.3100	-0.	5.3200	36.560	3.0100	-0.
199.00	1.1000	13.000	4.9600	68.530	9.2300	-0.	3.7600	60.420	4.7600	-0.	3.2400	55.840	7.1000	-0.
200.00	1.1000	12.000	8.3300	63.000	3.0300	-0.	5.5000	44.760	1.5700	-0.	8.4300	40.940	2.8700	-0.
201.00	1.1000	5.0000	4.8000	40.930	5.1400	-0.	1.6600	8.9400	4.0700	-0.	3.0300	23.140	3.9500	-0.
202.00	1.1000	9.0000	3.5700	15.750	5.9900	-0.	2.8900	5.9600	4.3000	-0.	2.8000	8.6700	4.6200	-0.
203.00	1.1000	9.0000	11.310	53.100	8.1700	-0.	7.9800	14.860	6.8200	-0.	8.0000	28.850	8.0400	-0.
204.00	1.1000	1.0000	5.5000	87.770	4.6500	-0.	2.8200	50.490	3.8900	-0.	3.7700	60.530	5.9600	-0.
205.00	1.1000	8.0000	6.5900	97.590	5.0500	-0.	4.6700	44.550	3.6400	-0.	6.3300	60.530	4.8900	-0.
206.00	1.1000	9.0000	3.8000	56.400	5.3300	-0.	2.2400	38.710	3.0400	-0.	2.8600	43.350	4.7600	-0.
207.00	1.1000	4.0000	8.5100	107.12	8.4500	-0.	5.0800	56.570	5.8800	-0.	6.6900	69.350	7.8500	-0.
208.00	1.1000	9.0000	4.1200	41.750	5.6800	-0.	1.8800	26.820	4.7400	-0.	2.9800	34.700	6.3200	-0.
209.00	1.1000	4.0000	11.120	34.660	10.170	-0.	8.7700	17.840	5.6300	-0.	9.4100	25.970	6.9700	-0.
210.00	1.1000	3.0000	5.3100	72.860	7.8500	-0.	3.5200	29.720	6.1400	-0.	5.2200	37.500	7.7100	-0.
211.00	1.1000	7.0000	5.6500	86.520	7.0800	-0.	3.9400	62.440	3.6900	-0.	4.9000	80.800	5.0800	-0.
212.00	1.1000	9.0000	5.7500	97.670	7.0200	-0.	4.0200	62.550	4.3500	-0.	5.5800	63.600	7.6600	-0.
213.00	1.1000	4.0000	5.0100	94.910	6.8400	-0.	3.5300	44.790	4.8300	-0.	3.8600	46.370	6.4700	-0.
214.00	1.1000	3.0000	7.4600	132.49	4.6700	-0.	4.7000	92.270	3.0800	-0.	4.9400	80.880	5.5200	-0.
215.00	1.1000	8.0000	5.3300	85.350	7.6700	-0.	3.9900	47.540	6.7100	-0.	5.3700	51.900	6.7300	-0.
216.00	1.1000	9.0000	4.0300	38.100	5.9700	-0.	2.0100	14.880	3.4900	-0.	2.8900	20.210	4.6200	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
217.00	1.1000	3.0000	4.3200	86.240	3.1900	-0.	5.3600	68.530	5.6600	-0.	6.6600	95.430	3.2000	-0.
218.00	1.1000	5.0000	4.3100	66.240	6.2600	-0.	2.3400	32.710	6.1500	-0.	3.4300	51.940	6.2000	-0.
219.00	1.1000	9.0000	4.9900	84.610	6.4900	-0.	3.7000	62.240	2.4400	-0.	4.5300	74.780	3.1000	-0.
220.00	1.1000	5.0000	5.1600	78.590	6.7300	-0.	3.9500	36.670	6.2700	-0.	4.6500	43.300	8.2900	-0.
221.00	1.1000	9.0000	3.9200	56.990	5.9400	-0.	3.2000	35.650	3.6800	-0.	4.0900	40.370	5.3100	-0.
222.00	1.1000	12.000	3.4100	34.620	3.6900	-0.	2.3000	11.910	2.6700	-0.	4.8100	20.230	3.5400	-0.
223.00	1.1000	5.0000	4.6000	72.400	7.9500	-0.	2.6300	14.880	6.5800	-0.	3.4900	20.210	7.9400	-0.
224.00	1.1000	3.0000	3.8800	40.850	8.7700	-0.	3.0900	29.730	5.2500	-0.	5.7000	28.860	7.7600	-0.
225.00	1.1000	5.0000	4.5200	63.080	5.2700	-0.	3.2900	35.730	3.8300	-0.	[illegible]	40.450	5.2800	-0.
226.00	1.1000	5.0000	9.3000	57.040	4.5400	-0.	3.3900	26.790	5.7500	-0.	6.2100	31.780	7.3600	-0.
227.00	1.1000	3.0000	12.960	122.97	6.8800	-0.	6.6000	41.580	6.3400	-0.	13.170	43.240	9.7000	-0.
228.00	1.1000	7.0000	4.3100	90.820	10.440	-0.	2.1600	53.390	7.1500	-0.	4.1700	54.690	10.260	-0.
229.00	1.1000	9.0000	5.7000	100.41	7.4000	-0.	2.7500	59.430	4.9100	-0.	4.8500	77.860	6.5700	-0.
230.00	1.1000	3.0000	3.9300	50.350	4.4900	-0.	2.4800	17.850	3.5600	-0.	3.8600	31.750	4.2500	-0.
231.00	1.1000	6.0000	6.2600	106.98	5.7400	-0.	3.4300	62.400	5.3300	-0.	5.0000	74.970	6.1700	-0.
232.00	1.1000	8.0000	4.9500	59.530	6.0800	-0.	2.9300	17.850	5.6800	-0.	3.3200	20.210	7.8300	-0.
233.00	1.1000	10.000	5.2400	43.790	10.090	-0.	3.3700	20.750	6.2200	-0.	5.4600	20.130	11.190	-0.
234.00	1.1000	5.0000	28.860	243.69	2.5400	-0.	31.110	222.13	1.6000	-0.	35.490	201.20	2.6600	-0.
235.00	1.1000	1.0000	3.8200	59.930	9.3500	-0.	2.5000	41.580	5.2400	-0.	3.8400	46.120	6.5400	-0.
236.00	1.1000	3.0000	5.7600	62.840	8.2700	-0.	5.1400	35.670	5.8300	-0.	6.1000	49.040	8.0500	-0.
237.00	1.1000	3.0000	4.4900	72.250	6.0000	-0.	3.2800	44.570	3.4500	-0.	3.6500	46.130	7.2500	-0.
238.00	1.1000	8.0000	6.8700	107.00	7.5800	-0.	4.7200	68.290	6.0700	-0.	6.2100	83.560	6.6400	-0.
239.00	1.1000	3.0000	4.0200	56.560	5.5500	-0.	1.6000	17.860	4.1300	-0.	4.2100	28.890	5.3700	-0.
240.00	1.1000	12.000	8.0600	97.960	1.8900	-0.	4.9800	74.360	2.5800	-0.	7.0200	66.390	1.8700	-0.
241.00	1.1000	9.0000	4.1100	40.920	6.1300	-0.	2.8600	20.820	4.0500	-0.	4.6200	25.980	5.9000	-0.
242.00	1.1000	9.0000	3.5000	37.740	4.5800	-0.	2.5500	26.760	2.6300	-0.	4.4100	25.970	3.9200	-0.
243.00	1.1000	5.0000	5.1800	72.170	7.0300	-0.	4.8900	26.680	6.1900	-0.	4.7100	31.650	8.1200	-0.
244.00	1.1000	10.000	4.8600	97.280	4.6700	-0.	4.7200	62.220	6.1500	-0.	6.5000	74.760	6.3900	-0.
245.00	1.1000	7.0000	6.3300	100.23	5.8500	-0.	3.5700	59.300	4.1200	-0.	4.7500	69.060	6.5000	-0.
246.00	1.1000	3.0000	6.8800	71.860	5.6600	-0.	2.5200	20.770	3.6100	-0.	2.9200	14.400	4.8100	-0.
247.00	1.1000	3.0000	3.9600	31.190	8.0100	-0.	3.1400	20.700	6.1500	-0.	3.3400	17.220	7.6500	-0.
248.00	1.1000	3.0000	6.3000	91.110	6.3000	-0.	4.6800	47.540	4.9800	-0.	5.5700	43.250	7.4400	-0.
249.00	1.1000	11.000	8.7800	109.46	4.7000	-0.	6.3500	83.050	2.6500	-0.	8.3400	77.720	4.6500	-0.
250.00	1.1000	3.0000	3.4900	90.350	5.1600	-0.	6.0600	59.380	3.8900	-0.	9.6100	54.750	5.4300	-0.
251.00	1.1000	9.0000	5.9800	74.880	12.950	-0.	3.9500	32.500	10.290	-0.	5.5800	28.670	13.230	-0.
252.00	1.1000	12.000	4.7400	59.280	4.1100	-0.	2.2700	23.630	2.5500	-0.	3.3000	34.400	3.4700	-0.
253.00	1.1000	9.0000	7.6000	52.880	9.4700	-0.	6.5800	35.580	6.7100	-0.	6.6000	37.400	9.7400	-0.
254.00	1.1000	3.0000	4.7000	49.950	10.580	-0.	3.1600	20.720	7.0300	-0.	3.2200	17.230	9.7400	-0.
255.00	1.1000	3.0000	3.8100	49.830	3.9400	-0.	2.8800	35.490	2.6100	-0.	3.2200	45.920	3.2000	-0.
256.00	1.1000	1.0000	4.4800	105.72	8.0200	-0.	7.5300	47.030	5.3100	-0.	3.9000	51.350	7.9000	-0.
257.00	1.1000	3.0000	3.4800	21.940	5.0200	-0.	2.6500	8.9000	3.2400	-0.	4.0300	14.390	4.7300	-0.
258.00	1.1000	9.0000	7.1900	90.150	6.6000	-0.	4.0600	47.220	4.9100	-0.	4.7500	51.550	7.1500	-0.
259.00	1.1000	9.0000	33.270	216.58	3.7100	-0.	26.770	246.35	2.4900	-0.	44.110	158.42	3.8300	-0.
260.00	1.1000	8.0000	2.6900	49.840	7.4100	-0.	[illegible]	36.430	6.6200	-0.	2.7400	40.170	8.5200	-0.
261.00	1.1000	1.0000	5.1900	74.470	11.680	-0.	3.6100	41.210	7.4800	-0.	4.7400	45.710	12.510	-0.
262.00	1.1000	5.0000	27.460	306.06	1.9200	-0.	8.8600	170.93	2.1000	-0.	9.3500	210.86	1.9900	-0.
263.00	1.1000	11.000	19.150	105.35	1.5100	-0.	4.2900	82.540	2.5700	-0.	8.1200	82.970	2.9900	-0.
264.00	1.1000	5.0000	6.8500	106.85	9.4400	-0.	6.1400	87.290	4.7400	-0.	8.1800	81.890	9.3800	-0.
265.00	1.1000	9.0000	4.9700	42.830	7.9000	-0.	3.3400	20.320	5.1700	-0.	4.2000	19.720	7.9700	-0.
266.00	1.1000	3.0000	4.3800	51.130	3.9400	-0.	2.7900	40.500	3.2900	-0.	2.9000	30.880	4.4500	-0.
267.00	1.1000	9.0000	5.3300	50.380	4.8700	-0.	2.7700	35.570	3.5200	-0.	3.3400	40.310	4.3200	-0.
268.00	1.1000	9.0000	3.6500	68.760	6.3600	-0.	3.1100	56.350	5.5100	-0.	3.4600	60.440	6.6000	-0.
269.00	1.1000	9.0000	4.7600	50.090	6.5200	-0.	3.5600	41.460	4.4600	-0.	4.0900	40.240	6.5500	-0.
270.00	1.1000	7.0000	4.6300	50.130	8.8400	-0.	3.2700	35.500	6.5700	-0.	3.6400	45.940	7.2100	-0.
271.00	1.1000	4.0000	2.7300	25.080	6.4100	-0.	2.3200	23.740	6.2300	-0.	2.9400	20.160	9.2800	-0.
272.00	1.1000	8.0000	6.4200	90.840	8.3200	-0.	4.7100	53.370	6.9500	-0.	4.9600	48.910	9.2600	-0.
273.00	1.1000	8.0000	6.7700	128.81	6.6200	-0.	4.7100	106.66	4.4600	-0.	5.6000	109.26	7.5100	-0.
274.00	1.1000	9.0000	7.8700	59.430	8.7300	-0.	8.2500	47.510	5.5100	-0.	11.470	46.100	6.3700	-0.
275.00	1.1000	9.0000	4.8300	53.260	5.7500	-0.	2.8900	26.720	4.1100	-0.	3.4200	25.930	6.2300	-0.
276.00	1.1000	12.000	4.5500	56.620	3.8600	-0.	2.0700	29.720	3.1400	-0.	3.8100	40.380	3.4500	-0.
277.00	1.1000	3.0000	5.4200	46.870	9.7400	-0.	3.7800	17.770	7.6100	-0.	4.3000	17.750	11.590	-0.
278.00	1.1000	3.0000	8.0300	81.570	5.7200	-0.	6.7100	56.310	4.5200	-0.	7.4900	54.650	6.0600	-0.
279.00	1.1000	1.0000	5.0800	59.620	7.7100	-0.	2.9900	41.420	4.4300	-0.	3.9200	54.550	7.1000	-0.
280.00	1.1000	8.0000	13.900	120.84	5.2100	-0.	4.0200	26.540	5.0200	-0.	5.5600	40.070	5.7700	-0.
281.00	1.1000	3.0000	4.2100	51.790	3.8700	-0.	2.1000	38.530	3.2400	-0.	2.4600	46.020	3.6500	-0.
282.00	1.1000	4.0000	5.1500	75.050	5.8800	-0.	4.2700	62.290	5.6300	-0.	5.7700	60.440	5.7000	-0.

32

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS
FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
283.00	1.1000	10.000	3.6800	40.710	10.430	-0.	2.5100	26.630	9.8100	-0.	3.6300	34.450	9.8700	-0.
284.00	1.1000	10.000	52.900	68.940	12.860	-0.	3.4700	47.510	8.0400	-0.	4.6500	51.870	11.820	-0.
285.00	1.1000	4.0000	4.6500	47.590	8.8400	-0.	2.6400	26.720	6.0200	-0.	2.7700	31.700	8.4300	-0.
286.00	1.1000	1.0000	5.1700	88.610	4.3600	-0.	3.0000	71.210	2.7200	-0.	3.7500	109.42	2.6900	-0.
287.00	1.1000	10.000	6.4900	151.22	3.3200	-0.	2.7800	89.040	3.5800	-0.	3.9800	103.69	4.2400	-0.
288.00	1.1000	10.000	4.4600	31.510	8.1800	-0.	3.1800	20.750	5.6700	-0.	3.6400	14.390	8.0100	-0.
289.00	1.1000	3.0000	9.2900	109.91	4.8900	-0.	4.2900	44.540	3.9600	-0.	4.9300	40.340	6.5700	-0.
290.00	1.1000	1.0000	5.1300	84.520	10.620	-0.	3.5100	29.540	9.5200	-0.	4.0500	40.140	10.380	-0.
291.00	1.1000	3.0000	9.5700	120.75	6.1000	-0.	6.8700	82.510	5.9400	-0.	9.2200	97.240	7.0600	-0.
292.00	1.1000	3.0000	6.7500	118.76	7.7000	-0.	3.5800	62.080	2.3200	-0.	5.9000	60.250	4.9500	-0.
293.00	1.1000	7.0000	7.9500	161.90	3.0400	-0.	4.0200	50.110	5.0000	-0.	4.7100	54.360	6.6400	-0.
294.00	1.1000	7.0000	3.9300	69.020	7.8000	-0.	2.3800	32.570	6.2700	-0.	2.5300	34.480	7.7600	-0.
295.00	1.1000	6.0000	11.570	128.78	6.9800	-0.	5.0700	101.26	4.8800	-0.	5.6800	87.130	8.0400	-0.
296.00	1.1000	9.0000	5.0600	77.120	5.2300	-0.	3.2700	42.840	4.3200	-0.	4.3700	55.330	5.7100	-0.
297.00	1.1000	9.0000	3.3800	46.350	10.000	-0.	2.5900	17.570	6.3600	-0.	2.7700	17.060	8.0400	-0.
298.00	1.1000	4.0000	4.5900	77.190	6.2400	-0.	3.1200	49.970	4.2700	-0.	4.2900	53.310	6.1900	-0.
299.00	1.1000	4.0000	2.9500	49.640	3.3600	-0.	1.5300	35.210	1.9500	-0.	3.1300	34.170	4.0300	-0.
300.00	1.1000	4.0000	5.3200	126.61	4.6700	-0.	4.3100	120.83	2.8700	-0.	5.0600	123.18	4.5700	-0.
ESTIMATE OF MEAN			7.2461	86.860	6.3293	0.	4.3935	49.334	4.7891	0.	5.8259	53.280	6.4091	0.
ESTIMATE OF STANDARD DEVIATION			5.7415	45.725	2.5924	-0.	3.4386	34.626	1.9625	-0.	4.7225	33.387	2.5013	-0.
DEGREES OF FREEDOM			149	149	149	0	149	149	149	0	149	149	149	0
T VALUE			15.457	23.265	29.902	-0.	13.649	17.350	29.888	-0.	15.109	19.545	31.382	-0.

33

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
151.00	1.1000	7.0000	4.9200	50.180	6.5500	-0.	2.2000	12.580	4.7600	-0.	2.4500	18.310	6.2300	-0.
151.00	1.2000	7.0000	4.0900	43.200	7.6600	-0.	2.2000	15.690	4.5800	-0.	-0.	-0.	-0.	-0.
152.00	1.1000	3.0000	6.9400	83.390	1.7200	-0.	2.1400	34.490	1.5700	-0.	5.8800	79.110	1.3500	-0.
152.00	1.2000	3.0000	7.4500	83.090	5.2500	-0.	6.0100	40.830	3.8800	-0.	-0.	-0.	-0.	-0.
153.00	1.1000	3.0000	6.4000	105.30	8.5000	-0.	5.9600	46.980	5.6900	-0.	5.5500	39.510	8.2600	-0.
153.00	1.2000	3.0000	6.1700	90.420	7.6300	-0.	4.3800	56.430	4.8100	-0.	-0.	-0.	-0.	-0.
154.00	1.1000	1.0000	5.1400	107.49	3.2400	-0.	2.5700	62.840	1.6600	-0.	3.9400	82.330	2.5600	-0.
154.00	1.2000	1.0000	5.7700	93.470	4.0500	-0.	3.4800	62.930	2.0900	-0.	-0.	-0.	-0.	-0.
155.00	1.1000	4.0000	9.9900	129.88	4.2400	-0.	11.310	88.070	2.7600	-0.	12.880	88.520	4.0700	-0.
155.00	1.2000	4.0000	7.8200	106.64	7.1100	-0.	5.2800	69.250	4.0300	-0.	-0.	-0.	-0.	-0.
156.00	1.1000	9.0000	7.0000	73.500	10.930	-0.	3.5700	28.460	7.2400	-0.	4.5600	30.690	10.040	-0.
156.00	1.2000	9.0000	6.2400	56.530	10.690	-0.	3.5500	15.290	7.7600	-0.	-0.	-0.	-0.	-0.
157.00	1.1000	3.0000	4.3900	29.880	11.510	-0.	2.5600	9.3900	9.2100	-0.	3.1100	9.1100	12.010	-0.
157.00	1.2000	3.0000	4.4600	40.050	9.6000	-0.	3.0500	9.4800	6.5600	-0.	-0.	-0.	-0.	-0.
158.00	1.1000	12.000	7.8200	63.260	1.6300	-0.	5.0800	56.410	1.2500	-0.	7.5500	45.620	1.4500	-0.
158.00	1.2000	12.000	10.130	93.380	4.3200	-0.	9.0000	75.510	2.1700	-0.	-0.	-0.	-0.	-0.
159.00	1.1000	9.0000	7.2100	103.91	7.8600	-0.	3.1000	63.200	5.5000	-0.	4.2400	73.600	7.6000	-0.
159.00	1.2000	9.0000	5.5100	49.940	8.2700	-0.	2.6800	22.020	5.3400	-0.	-0.	-0.	-0.	-0.
160.00	1.1000	3.0000	11.750	184.50	3.4200	-0.	4.5900	69.420	2.6700	-0.	6.0900	67.370	4.6100	-0.
160.00	1.2000	3.0000	8.9000	93.470	5.1900	-0.	4.3800	25.250	3.8200	-0.	-0.	-0.	-0.	-0.
161.00	1.1000	12.000	4.8700	59.670	6.0400	-0.	2.8700	22.100	5.7400	-0.	4.5200	30.640	6.4000	-0.
161.00	1.2000	12.000	3.9600	53.220	8.4800	-0.	2.2100	22.040	5.7100	-0.	-0.	-0.	-0.	-0.
162.00	1.1000	3.0000	6.9900	83.530	8.8300	-0.	3.7600	37.780	5.7600	-0.	4.2600	33.610	8.1600	-0.
162.00	1.2000	3.0000	5.1100	43.210	9.5900	-0.	3.3400	22.020	6.0000	-0.	-0.	-0.	-0.	-0.
163.00	1.1000	9.0000	6.7200	94.400	6.2800	-0.	4.5000	56.780	4.1200	-0.	4.6800	52.040	6.1900	-0.
163.00	1.2000	9.0000	7.4000	112.22	5.3400	-0.	4.8400	59.820	3.7300	-0.	-0.	-0.	-0.	-0.
164.00	1.1000	13.000	14.410	117.04	4.1200	-0.	11.370	91.700	1.2100	-0.	14.860	82.860	2.0000	-0.
164.00	1.2000	13.000	10.670	99.200	4.0000	-0.	8.1900	84.950	1.5400	-0.	-0.	-0.	-0.	-0.
165.00	1.1000	7.0000	6.5900	96.040	8.7300	-0.	3.8800	53.450	6.0300	-0.	5.1200	57.970	7.0600	-0.
165.00	1.2000	7.0000	5.7300	89.750	7.1600	-0.	4.8600	53.510	6.5500	-0.	-0.	-0.	-0.	-0.
166.00	1.1000	2.0000	14.260	211.78	2.5700	-0.	11.210	141.49	1.5400	-0.	15.010	106.80	4.1300	-0.
166.00	1.2000	2.0000	11.600	159.50	6.9500	-0.	9.1600	132.15	3.7700	-0.	-0.	-0.	-0.	-0.
167.00	1.1000	1.0000	9.4700	122.75	6.8800	-0.	6.2600	53.450	5.8100	-0.	8.1600	54.920	9.8400	-0.
167.00	1.2000	1.0000	6.5400	113.19	7.0800	-0.	4.9800	50.470	5.4500	-0.	-0.	-0.	-0.	-0.
168.00	1.1000	7.0000	9.1900	170.22	6.2900	-0.	4.5000	56.530	5.0200	-0.	5.4500	73.150	6.5700	-0.
168.00	1.2000	7.0000	7.9600	160.46	5.9500	-0.	4.9400	88.450	3.0700	-0.	-0.	-0.	-0.	-0.
169.00	1.1000	5.0000	10.880	114.29	4.9800	-0.	7.0900	72.320	5.6100	-0.	9.6000	82.390	6.6400	-0.
169.00	1.2000	5.0000	6.7600	40.690	6.4200	-0.	3.9500	12.630	4.5400	-0.	-0.	-0.	-0.	-0.
170.00	1.1000	5.0000	5.6700	66.960	5.0900	-0.	3.8300	28.320	3.6100	-0.	5.6300	30.530	4.4200	-0.
170.00	1.2000	5.0000	4.8500	40.000	5.7800	-0.	3.1400	9.4600	4.6300	-0.	-0.	-0.	-0.	-0.
171.00	1.1000	7.0000	11.870	126.50	1.2700	-0.	5.9100	97.880	.54000	-0.	8.8800	107.25	1.3500	-0.
171.00	1.2000	7.0000	13.200	154.78	1.7200	-0.	8.7700	115.71	1.4400	-0.	-0.	-0.	-0.	-0.
172.00	1.1000	5.0000	6.3800	87.830	7.5000	-0.	3.9400	34.610	6.0800	-0.	4.2300	33.590	7.9500	-0.
172.00	1.2000	5.0000	8.3800	123.26	5.9800	-0.	4.8600	72.210	4.1700	-0.	-0.	-0.	-0.	-0.
173.00	1.1000	2.0000	5.1000	116.75	3.9400	-0.	3.2700	59.870	5.8200	-0.	6.3500	85.620	5.8000	-0.
173.00	1.2000	2.0000	6.4100	115.96	6.0300	-0.	4.7600	62.730	4.8200	-0.	-0.	-0.	-0.	-0.
174.00	1.1000	12.000	8.0500	66.490	4.1000	-0.	3.5600	34.660	4.3700	-0.	5.0000	36.700	4.1000	-0.
174.00	1.2000	12.000	6.6700	69.140	3.3200	-0.	3.9100	34.300	2.7500	-0.	-0.	-0.	-0.	-0.
175.00	1.1000	11.000	5.9200	94.690	2.8000	-0.	2.6500	40.770	2.9400	-0.	7.1400	106.53	1.6800	-0.
175.00	1.2000	11.000	6.6000	125.95	3.3100	-0.	3.5400	37.610	4.3100	-0.	-0.	-0.	-0.	-0.
176.00	1.1000	8.0000	7.8500	152.93	4.3300	-0.	3.3500	21.900	7.6900	-0.	4.6500	39.470	8.6500	-0.
176.00	1.2000	8.0000	8.4400	161.88	4.1600	-0.	5.2000	49.980	6.4200	-0.	-0.	-0.	-0.	-0.
177.00	1.1000	3.0000	5.8300	105.51	5.0300	-0.	2.6900	56.250	3.0600	-0.	3.8300	60.650	4.1700	-0.
177.00	1.2000	3.0000	7.0500	109.50	5.6500	-0.	3.7300	73.110	4.9000	-0.	-0.	-0.	-0.	-0.
178.00	1.1000	1.0000	6.4400	106.10	3.4300	-0.	5.2200	90.950	3.0300	-0.	5.6100	79.130	4.7700	-0.
178.00	1.2000	1.0000	5.9100	96.560	5.8800	-0.	4.7700	68.970	4.9500	-0.	-0.	-0.	-0.	-0.
179.00	1.1000	8.0000	6.9400	56.640	15.600	-0.	4.5400	9.4300	12.200	-0.	4.8100	12.200	12.960	-0.
179.00	1.2000	8.0000	7.4900	82.360	7.0700	-0.	5.2200	6.2200	6.8200	-0.	-0.	-0.	-0.	-0.
180.00	1.1000	3.0000	6.1200	76.330	7.1000	-0.	3.6800	40.770	4.6000	-0.	4.7500	33.480	8.1800	-0.
180.00	1.2000	3.0000	6.1800	76.530	7.1000	-0.	4.0300	65.560	3.4300	-0.	-0.	-0.	-0.	-0.
181.00	1.1000	2.0000	5.0100	102.37	4.1100	-0.	2.9600	59.100	2.9500	-0.	4.4900	48.300	5.1600	-0.
181.00	1.2000	2.0000	4.1100	59.270	4.3400	-0.	3.5800	53.130	2.1000	-0.	-0.	-0.	-0.	-0.
182.00	1.1000	3.0000	8.9600	142.15	7.0300	-0.	4.5300	53.240	6.5200	-0.	5.6200	48.630	10.390	-0.
182.00	1.2000	3.0000	6.5600	78.870	9.5300	-0.	4.2000	34.360	14.670	-0.	-0.	-0.	-0.	-0.
183.00	1.1000	3.0000	7.0300	105.94	5.6600	-0.	4.2800	43.860	6.2000	-0.	5.6000	42.570	8.3300	-0.
183.00	1.2000	3.0000	8.2400	66.040	4.6600	-0.	4.5500	31.250	4.6000	-0.	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
184.00	1.1000	3.0000	8.5600	155.52	3.5100	-0.	4.8400	78.320	3.2700	-0.	6.0100	60.810	6.4000	-0.
184.00	1.2000	3.0000	5.9500	112.24	5.1200	-0.	3.5800	68.700	2.8300	-0.	-0.	-0.	-0.	-0.
185.00	1.1000	2.0000	4.9300	98.580	7.4200	-0.	3.0200	37.490	6.2700	-0.	3.7400	33.350	9.1300	-0.
185.00	1.2000	2.0000	5.6900	95.060	10.320	-0.	4.3400	65.390	7.2100	-0.	-0.	-0.	-0.	-0.
186.00	1.1000	3.0000	4.2200	62.500	5.2400	-0.	1.6900	34.380	3.1200	-0.	2.2700	36.390	5.3700	-0.
186.00	1.2000	3.0000	3.3300	36.250	6.6700	-0.	1.1100	24.890	2.7200	-0.	-0.	-0.	-0.	-0.
187.00	1.1000	9.0000	4.4900	43.190	9.0200	-0.	2.9700	18.740	6.7400	-0.	3.6900	15.160	8.4100	-0.
187.00	1.2000	9.0000	4.9900	59.380	10.460	-0.	3.2400	18.740	7.9500	-0.	-0.	-0.	-0.	-0.
188.00	1.1000	5.0000	13.600	109.03	4.5200	-0.	10.080	68.780	4.9500	-0.	16.680	72.810	5.0800	-0.
188.00	1.2000	5.0000	7.8000	108.97	2.7600	-0.	12.150	37.460	1.3800	-0.	-0.	-0.	-0.	-0.
189.00	1.1000	11.000	5.6200	76.130	9.4600	-0.	3.4900	28.050	5.6700	-0.	3.7400	30.270	7.5300	-0.
189.00	1.2000	11.000	6.5100	92.470	8.9500	-0.	3.7900	40.600	5.9600	-0.	-0.	-0.	-0.	-0.
190.00	1.1000	9.0000	6.2800	98.830	7.1600	-0.	4.5000	68.480	4.8500	-0.	6.2500	78.540	6.2100	-0.
190.00	1.2000	9.0000	5.0700	75.260	8.2600	-0.	3.9800	43.550	6.7600	-0.	-0.	-0.	-0.	-0.
191.00	1.1000	7.0000	8.5000	115.00	12.850	-0.	6.7100	90.270	6.6300	-0.	6.9100	96.670	9.7200	-0.
191.00	1.2000	7.0000	9.0900	131.22	11.970	-0.	5.9900	81.050	8.1200	-0.	-0.	-0.	-0.	-0.
192.00	1.1000	9.0000	6.8300	59.460	9.7700	-0.	3.8100	15.580	8.4000	-0.	4.4100	15.120	8.0500	-0.
192.00	1.2000	9.0000	5.7100	78.360	8.0400	-0.	4.0800	18.060	8.5200	-0.	-0.	-0.	-0.	-0.
193.00	1.1000	9.0000	8.4500	85.240	7.0100	-0.	5.7900	49.750	3.9800	-0.	7.2800	54.320	5.9100	-0.
193.00	1.2000	9.0000	8.4300	68.980	7.6400	-0.	6.1100	45.980	3.7200	-0.	-0.	-0.	-0.	-0.
194.00	1.1000	12.000	7.2800	78.950	3.1000	-0.	4.9300	50.040	1.9100	-0.	7.1300	51.590	2.5700	-0.
194.00	1.2000	12.000	6.7200	68.640	3.4200	-0.	5.4000	43.530	1.8000	-0.	-0.	-0.	-0.	-0.
195.00	1.1000	3.0000	8.6000	88.800	6.0400	-0.	6.2200	21.850	4.7500	-0.	6.5700	30.300	6.1700	-0.
195.00	1.2000	3.0000	6.9400	46.010	9.6800	-0.	5.5100	8.8800	8.5100	-0.	-0.	-0.	-0.	-0.
196.00	1.1000	9.0000	7.1200	116.56	4.7800	-0.	1.8100	17.870	4.0800	-0.	2.6600	23.130	5.7300	-0.
196.00	1.2000	9.0000	4.1400	40.880	6.6100	-0.	2.3700	11.880	4.5600	-0.	-0.	-0.	-0.	-0.
197.00	1.1000	8.0000	19.580	307.94	2.1100	-0.	8.3900	141.70	1.7500	-0.	12.890	179.61	1.9900	-0.
197.00	1.2000	8.0000	8.7400	199.31	1.9300	-0.	3.9200	41.720	2.8700	-0.	-0.	-0.	-0.	-0.
198.00	1.1000	12.000	5.2100	63.750	3.6300	-0.	3.2500	34.780	2.3100	-0.	5.3200	36.560	3.0100	-0.
198.00	1.2000	12.000	5.6400	62.580	4.2300	-0.	2.8800	34.510	2.5000	-0.	-0.	-0.	-0.	-0.
199.00	1.1000	13.000	4.9600	68.530	9.2300	-0.	3.7600	60.420	4.7600	-0.	3.2400	55.840	7.1000	-0.
199.00	1.2000	13.000	3.3500	44.150	2.7500	-0.	1.6600	29.790	1.3700	-0.	-0.	-0.	-0.	-0.
200.00	1.1000	12.000	9.3300	63.000	3.0300	-0.	5.5000	44.760	1.5700	-0.	8.4300	40.540	2.8700	-0.
200.00	1.2000	12.000	6.3700	44.730	3.2000	-0.	3.0600	26.750	1.9700	-0.	-0.	-0.	-0.	-0.
201.00	1.1000	5.0000	4.8000	40.930	5.1400	-0.	1.6600	8.9400	4.0700	-0.	3.0300	23.140	3.9500	-0.
201.00	1.2000	5.0000	3.8100	25.250	7.6600	-0.	2.0900	5.9500	6.4700	-0.	-0.	-0.	-0.	-0.
202.00	1.1000	9.0000	3.5700	15.750	5.9900	-0.	2.8900	5.9600	4.3000	-0.	2.8000	8.6700	4.6200	-0.
202.00	1.2000	9.0000	2.9400	15.690	5.3800	-0.	2.1200	5.9400	3.8400	-0.	-0.	-0.	-0.	-0.
203.00	1.1000	9.0000	11.310	53.100	8.1700	-0.	7.9800	14.860	6.8200	-0.	8.0000	28.850	8.0400	-0.
203.00	1.2000	9.0000	14.760	103.80	6.8300	-0.	11.090	20.830	6.5100	-0.	-0.	-0.	-0.	-0.
204.00	1.1000	1.0000	5.5000	87.770	4.6500	-0.	2.8200	50.490	3.8900	-0.	3.7700	60.530	5.9600	-0.
204.00	1.2000	1.0000	5.1600	107.31	6.2900	-0.	3.2400	62.660	3.7200	-0.	-0.	-0.	-0.	-0.
205.00	1.1000	8.0000	6.5900	97.590	5.0500	-0.	4.6700	44.550	3.6400	-0.	6.3300	60.530	4.8900	-0.
205.00	1.2000	8.0000	6.8700	91.840	4.4700	-0.	4.3800	41.670	3.2400	-0.	-0.	-0.	-0.	-0.
206.00	1.1000	9.0000	3.8000	56.400	5.3300	-0.	2.2400	38.710	3.0400	-0.	2.8600	43.350	4.7600	-0.
206.00	1.2000	9.0000	3.9700	53.840	6.1900	-0.	2.6400	32.850	4.0100	-0.	-0.	-0.	-0.	-0.
207.00	1.1000	4.0000	8.5100	107.12	8.4500	-0.	5.0800	56.570	5.8800	-0.	6.6900	69.350	7.8500	-0.
207.00	1.2000	4.0000	9.5500	127.56	5.0200	-0.	4.2100	38.750	4.7600	-0.	-0.	-0.	-0.	-0.
208.00	1.1000	9.0000	4.1200	41.750	5.6800	-0.	1.8800	26.820	4.7400	-0.	2.9800	34.700	6.3200	-0.
208.00	1.2000	9.0000	13.240	154.53	4.1100	-0.	2.2000	11.930	4.5200	-0.	-0.	-0.	-0.	-0.
209.00	1.1000	4.0000	11.120	34.660	10.170	-0.	8.7700	17.840	5.6300	-0.	9.4100	25.970	6.9700	-0.
209.00	1.2000	4.0000	15.520	98.130	6.8600	-0.	12.360	47.590	4.6700	-0.	-0.	-0.	-0.	-0.
210.00	1.1000	3.0000	5.3100	72.860	7.8500	-0.	3.5200	29.720	6.1400	-0.	5.2200	37.500	7.7100	-0.
210.00	1.2000	3.0000	5.3400	78.960	4.8400	-0.	2.8300	20.920	3.6800	-0.	-0.	-0.	-0.	-0.
211.00	1.1000	7.0000	5.6500	88.520	7.0800	-0.	3.9400	62.440	3.6900	-0.	4.9000	80.800	5.0800	-0.
211.00	1.2000	7.0000	6.2700	104.26	6.8200	-0.	4.6500	74.730	4.0100	-0.	-0.	-0.	-0.	-0.
212.00	1.1000	9.0000	5.7500	97.670	7.0200	-0.	4.0200	62.550	4.3500	-0.	5.5800	63.600	7.6600	-0.
212.00	1.2000	9.0000	4.8500	72.430	9.7800	-0.	3.8800	59.550	5.5700	-0.	-0.	-0.	-0.	-0.
213.00	1.1000	4.0000	5.0100	94.910	6.8400	-0.	3.5300	44.790	4.8300	-0.	3.8600	46.370	6.4700	-0.
213.00	1.2000	4.0000	4.0800	54.290	6.1000	-0.	2.5700	11.910	4.8800	-0.	-0.	-0.	-0.	-0.
214.00	1.1000	3.0000	7.4600	132.49	4.6700	-0.	4.7000	92.270	3.0800	-0.	4.9400	80.880	5.5200	-0.
214.00	1.2000	3.0000	6.2100	94.460	8.7700	-0.	3.8200	90.380	9.2300	-0.	-0.	-0.	-0.	-0.
215.00	1.1000	8.0000	5.3300	85.350	7.6700	-0.	3.9900	47.540	6.7100	-0.	5.3700	51.900	6.7300	-0.
215.00	1.2000	8.0000	5.1900	94.490	7.1600	-0.	3.1700	41.600	6.3900	-0.	-0.	-0.	-0.	-0.
216.00	1.1000	9.0000	4.0300	38.100	5.9700	-0.	2.0100	14.880	3.4900	-0.	2.8900	20.210	6.6200	-0.
216.00	1.2000	9.0000	4.5500	44.050	9.0700	-0.	2.9700	17.870	5.8900	-0.	-0.	-0.	-0.	-0.

35

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	[illegible] 7MODE	NOXP 7MODE
217.00	1.1000	3.0000	4.3200	86.240	3.1900	-0.	5.3600	68.530	5.6600	-0.	6.6600	95.430	3.2000	-0.
217.00	1.2000	3.0000	3.7000	22.000	7.5300	-0.	2.7000	8.9200	4.8300	-0.	-0.	-0.	-0.	-0.
218.00	1.1000	5.0000	4.3100	66.240	6.2600	-0.	2.3400	32.710	6.1500	-0.	3.4300	51.940	6.2000	-0.
218.00	1.2000	5.0000	4.7600	56.940	6.5900	-0.	2.8200	32.710	4.8700	-0.	-0.	-0.	-0.	-0.
219.00	1.1000	9.0000	4.9900	84.810	4.4900	-0.	3.7000	62.240	2.4400	-0.	4.5300	74.780	3.1000	-0.
219.00	1.2000	9.0000	5.1600	87.730	4.4300	-0.	3.9100	65.160	2.3400	-0.	-0.	-0.	-0.	-0.
220.00	1.1000	5.0000	5.1600	78.590	6.7300	-0.	3.9500	38.670	6.2700	-0.	4.6500	43.300	8.2900	-0.
220.00	1.2000	5.0000	5.4300	81.770	7.8200	-0.	3.2300	26.730	6.5200	-0.	-0.	-0.	-0.	-0.
221.00	1.1000	9.0000	3.9200	56.990	5.9400	-0.	3.2000	35.650	3.6800	-0.	4.6900	40.370	5.3100	-0.
221.00	1.2000	9.0000	8.0900	103.82	4.7500	-0.	2.5200	26.830	3.3800	-0.	-0.	-0.	-0.	-0.
222.00	1.1000	12.000	3.4100	34.620	3.6900	-0.	2.3000	11.910	2.6700	-0.	4.8100	20.230	3.5400	-0.
222.00	1.2000	12.000	4.6200	53.310	6.8100	-0.	1.8600	14.850	4.0900	-0.	-0.	-0.	-0.	-0.
223.00	1.1000	5.0000	4.6000	72.400	7.9500	-0.	2.6300	14.880	6.5800	-0.	3.4900	20.210	7.9400	-0.
223.00	1.2000	5.0000	4.6600	62.720	7.9400	-0.	2.0700	14.810	5.1100	-0.	-0.	-0.	-0.	-0.
224.00	1.1000	3.0000	3.8800	40.850	8.7700	-0.	3.0900	29.730	5.2500	-0.	5.7000	28.860	7.7600	-0.
224.00	1.2000	3.0000	3.6000	28.220	7.5100	-0.	1.9500	17.770	4.7600	-0.	-0.	-0.	-0.	-0.
225.00	1.1000	5.0000	4.5200	63.080	5.2700	-0.	3.2900	35.730	3.8300	-0.	4.0100	40.450	5.2800	-0.
225.00	1.2000	5.0000	5.9600	69.150	7.0200	-0.	3.6000	32.680	5.0500	-0.	-0.	-0.	-0.	-0.
226.00	1.1000	5.0000	9.3000	57.040	4.5400	-0.	3.3900	26.790	5.7500	-0.	6.2100	31.780	7.3600	-0.
226.00	1.2000	5.0000	6.0300	50.480	2.7100	-0.	2.5400	20.790	1.7300	-0.	-0.	-0.	-0.	-0.
227.00	1.1000	3.0000	12.960	122.97	6.8800	-0.	6.6000	41.580	6.3400	-0.	13.170	43.240	9.7000	-0.
227.00	1.2000	3.0000	4.8600	41.030	9.8700	-0.	3.4300	23.810	6.0800	-0.	-0.	-0.	-0.	-0.
228.00	1.1000	7.0000	4.3100	90.820	10.440	-0.	2.1600	53.390	7.1500	-0.	4.1700	54.690	10.260	-0.
228.00	1.2000	7.0000	3.8800	88.150	5.7100	-0.	2.5200	44.620	4.2000	-0.	-0.	-0.	-0.	-0.
229.00	1.1000	9.0000	5.7000	100.41	7.4000	-0.	2.7500	59.430	4.9100	-0.	4.8500	77.860	6.5700	-0.
229.00	1.2000	9.0000	4.0600	50.240	7.4900	-0.	1.7200	23.740	4.5300	-0.	-0.	-0.	-0.	-0.
230.00	1.1000	3.0000	3.9300	50.350	4.4900	-0.	2.4800	17.850	3.5600	-0.	3.8600	31.750	4.2500	-0.
230.00	1.2000	3.0000	4.5000	41.120	7.4800	-0.	4.4100	14.880	4.9900	-0.	-0.	-0.	-0.	-0.
231.00	1.1000	6.0000	6.2600	106.98	5.7400	-0.	3.4300	62.400	5.3300	-0.	5.0000	74.970	6.1700	-0.
231.00	1.2000	6.0000	5.4200	56.750	9.2900	-0.	3.0800	32.720	6.6300	-0.	-0.	-0.	-0.	-0.
232.00	1.1000	8.0000	4.9500	59.530	6.0800	-0.	2.9300	17.850	5.6800	-0.	3.3200	20.210	7.8300	-0.
232.00	1.2000	8.0000	7.0700	91.130	7.9800	-0.	4.0900	38.700	6.9800	-0.	-0.	-0.	-0.	-0.
233.00	1.1000	10.000	5.2400	43.790	10.090	-0.	3.3700	20.750	6.2200	-0.	5.4600	20.130	11.190	-0.
233.00	1.2000	10.000	5.1900	50.230	10.420	-0.	3.6300	32.790	7.6800	-0.	-0.	-0.	-0.	-0.
234.00	1.1000	5.0000	28.860	243.69	2.5400	-0.	31.110	222.13	1.6000	-0.	35.490	201.20	2.6600	-0.
234.00	1.2000	5.0000	4.6500	84.480	3.7400	-0.	1.9100	38.430	2.1500	-0.	-0.	-0.	-0.	-0.
235.00	1.1000	1.0000	3.8200	59.930	9.3500	-0.	2.5000	41.580	5.2400	-0.	3.8400	46.120	8.5400	-0.
235.00	1.2000	1.0000	2.7100	34.530	10.460	-0.	1.8300	17.820	5.7800	-0.	-0.	-0.	-0.	-0.
236.00	1.1000	3.0000	5.7600	62.840	8.2700	-0.	5.1400	35.670	5.8300	-0.	6.1000	49.040	8.0500	-0.
236.00	1.2000	3.0000	3.6000	50.140	5.8400	-0.	2.4600	20.810	5.4100	-0.	-0.	-0.	-0.	-0.
237.00	1.1000	3.0000	4.4900	72.250	6.0000	-0.	3.2800	44.570	3.4500	-0.	3.6500	46.130	7.2500	-0.
237.00	1.2000	3.0000	4.1800	40.840	7.6300	-0.	2.9400	17.830	4.5600	-0.	-0.	-0.	-0.	-0.
238.00	1.1000	8.0000	6.8700	107.00	7.5800	-0.	4.7200	68.290	6.0700	-0.	6.2100	83.560	6.6400	-0.
238.00	1.2000	8.0000	6.4900	81.150	7.0000	-0.	4.2700	61.490	5.3000	-0.	-0.	-0.	-0.	-0.
239.00	1.1000	3.0000	4.0200	56.560	5.5500	-0.	1.6000	17.860	4.1300	-0.	4.2100	28.890	5.3700	-0.
239.00	1.2000	3.0000	7.9000	50.400	6.9000	-0.	4.6200	23.670	5.8300	-0.	-0.	-0.	-0.	-0.
240.00	1.1000	12.000	8.0600	97.960	1.8900	-0.	4.9800	74.360	2.5600	-0.	7.0200	66.390	1.8700	-0.
240.00	1.2000	12.000	11.110	103.37	1.7900	-0.	5.7500	85.920	.92000	-0.	-0.	-0.	-0.	-0.
241.00	1.1000	9.0000	4.1100	40.920	6.1300	-0.	2.8600	20.820	4.0500	-0.	4.6200	25.980	5.9000	-0.
241.00	1.2000	9.0000	6.4800	90.720	6.3800	-0.	4.1600	62.260	4.1300	-0.	-0.	-0.	-0.	-0.
242.00	1.1000	9.0000	3.5000	37.740	4.5800	-0.	2.5500	26.760	2.6300	-0.	4.4100	25.970	3.9200	-0.
242.00	1.2000	9.0000	5.2200	53.340	4.8000	-0.	3.3100	29.670	2.9200	-0.	-0.	-0.	-0.	-0.
243.00	1.1000	5.0000	5.1800	72.170	7.0300	-0.	4.8900	26.530	8.1900	-0.	4.7100	31.650	8.1200	-0.
243.00	1.2000	5.0000	4.5000	74.980	5.9700	-0.	2.9900	35.490	4.6500	-0.	-0.	-0.	-0.	-0.
244.00	1.1000	10.000	4.8600	97.280	4.6700	-0.	4.7200	62.220	6.1500	-0.	6.5000	74.760	6.3900	-0.
244.00	1.2000	10.000	6.4700	112.88	7.3300	-0.	3.3900	32.710	5.4900	-0.	-0.	-0.	-0.	-0.
245.00	1.1000	7.0000	6.3300	100.23	5.8500	-0.	3.5700	59.300	4.1200	-0.	4.7500	69.060	6.5000	-0.
245.00	1.2000	7.0000	5.7200	90.860	7.1500	-0.	3.1400	44.490	5.2300	-0.	-0.	-0.	-0.	-0.
246.00	1.1000	3.0000	6.8800	71.860	5.6600	-0.	2.5200	20.770	3.6100	-0.	2.9200	14.400	4.8100	-0.
246.00	1.2000	3.0000	8.6800	100.38	3.0200	-0.	2.6700	41.510	2.1100	-0.	-0.	-0.	-0.	-0.
247.00	1.1000	3.0000	3.9600	31.190	8.0100	-0.	3.1400	20.700	5.1500	-0.	3.3400	17.220	7.8500	-0.
247.00	1.2000	3.0000	4.8300	56.580	8.3800	-0.	3.2300	20.750	5.9300	-0.	-0.	-0.	-0.	-0.
248.00	1.1000	3.0000	6.3000	91.110	6.3000	-0.	4.6800	67.540	4.9900	-0.	5.5700	43.250	7.4400	-0.
248.00	1.2000	3.0000	5.6900	65.790	7.0400	-0.	3.6900	29.480	4.7400	-0.	-0.	-0.	-0.	-0.
249.00	1.1000	11.000	8.7800	139.46	4.7000	-0.	6.3500	[illegible]	2.6500	-0.	8.3400	77.720	4.6500	-0.
249.00	1.2000	11.000	7.9000	199.16	5.1600	-0.	5.6400	77.170	2.4500	-0.	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
250.00	1.1000	3.0000	8.4900	90.850	5.1600	-0.	6.0600	59.380	3.6900	-0.	9.6100	54.750	5.4300	-0.
250.00	1.2000	3.0000	5.8700	75.150	5.8600	-0.	3.9200	38.460	4.3900	-0.	-0.	-0.	-0.	-0.
251.00	1.1000	9.0000	5.9800	74.880	12.950	-0.	3.9500	32.500	10.290	-0.	5.5800	28.670	13.230	-0.
251.00	1.2000	9.0000	4.6000	48.900	9.5900	-0.	3.0300	23.250	6.9200	-0.	-0.	-0.	-0.	-0.
252.00	1.1000	12.000	4.7800	59.280	4.1100	-0.	2.2700	23.630	2.5500	-0.	3.3000	34.400	3.4700	-0.
252.00	1.2000	12.000	4.3900	59.240	4.0100	-0.	2.3300	23.690	3.3700	-0.	-0.	-0.	-0.	-0.
253.00	1.1000	9.0000	7.6000	52.880	9.4700	-0.	6.5900	35.580	6.7100	-0.	6.6000	37.400	9.7400	-0.
253.00	1.2000	9.0000	7.3300	37.530	9.0100	-0.	5.1800	14.800	6.1200	-0.	-0.	-0.	-0.	-0.
254.00	1.1000	3.0000	4.7000	49.950	10.580	-0.	3.1600	20.720	7.0300	-0.	3.2200	17.230	9.7400	-0.
254.00	1.2000	3.0000	7.6100	43.540	13.030	-0.	5.9600	26.610	9.6800	-0.	-0.	-0.	-0.	-0.
255.00	1.1000	3.0000	3.8100	49.830	3.9400	-0.	2.8800	35.490	2.6100	-0.	3.2200	45.920	3.2000	-0.
255.00	1.2000	3.0000	4.6700	84.050	2.6300	-0.	3.7900	67.950	1.9300	-0.	-0.	-0.	-0.	-0.
256.00	1.1000	1.0000	4.4800	105.72	8.0200	-0.	2.5300	47.030	5.3100	-0.	3.9000	51.350	7.9000	-0.
256.00	1.2000	1.0000	4.2100	88.450	6.2600	-0.	2.7600	46.640	4.2700	-0.	-0.	-0.	-0.	-0.
257.00	1.1000	3.0000	3.4800	21.940	5.0200	-0.	2.6500	8.9000	3.2300	-0.	4.0300	14.390	4.7300	-0.
257.00	1.2000	3.0000	5.1400	68.370	5.0700	-0.	4.0100	53.120	3.3400	-0.	-0.	-0.	-0.	-0.
258.00	1.1000	9.0000	7.1900	90.150	6.6000	-0.	4.0600	47.220	4.9100	-0.	4.7500	51.550	7.1500	-0.
258.00	1.2000	9.0000	9.4800	87.860	12.050	-0.	4.5900	34.510	6.6300	-0.	-0.	-0.	-0.	-0.
259.00	1.1000	9.0000	33.270	216.58	3.7100	-0.	26.770	246.35	2.4900	-0.	44.110	158.42	3.8300	-0.
259.00	1.2000	9.0000	7.9700	102.45	7.0100	-0.	6.2600	94.600	5.6100	-0.	-0.	-0.	-0.	-0.
260.00	1.1000	8.0000	2.6900	49.840	7.4100	-0.	2.4700	38.430	6.6200	-0.	2.7400	40.170	8.5200	-0.
260.00	1.2000	8.0000	5.7800	85.370	5.4100	-0.	3.0100	58.730	2.8800	-0.	-0.	-0.	-0.	-0.
261.00	1.1000	1.0000	5.1900	74.470	11.680	-0.	3.6100	41.210	7.4800	-0.	4.7400	45.710	12.510	-0.
261.00	1.2000	1.0000	5.1300	83.950	8.1300	-0.	3.5200	41.330	6.7400	-0.	-0.	-0.	-0.	-0.
262.00	1.1000	5.0000	27.460	306.06	1.9200	-0.	8.8600	170.93	2.1000	-0.	9.3500	210.86	1.9900	-0.
262.00	1.2000	5.0000	12.150	194.34	2.7200	-0.	5.6100	95.080	2.9600	-0.	-0.	-0.	-0.	-0.
263.00	1.1000	11.000	19.150	105.35	1.5100	-0.	4.2900	82.540	2.5700	-0.	8.1200	82.970	2.9900	-0.
263.00	1.2000	11.000	4.0100	51.780	6.4300	-0.	2.5400	40.630	4.6000	-0.	-0.	-0.	-0.	-0.
264.00	1.1000	5.0000	6.8500	106.85	9.4400	-0.	6.1400	87.290	6.7400	-0.	8.1800	81.890	9.3800	-0.
264.00	1.2000	5.0000	6.4700	97.650	7.5300	-0.	4.4900	58.260	6.6000	-0.	-0.	-0.	-0.	-0.
265.00	1.1000	9.0000	4.9700	42.830	7.9000	-0.	3.3400	20.320	5.1700	-0.	4.2000	19.720	7.9700	-0.
265.00	1.2000	9.0000	6.3700	106.48	5.6800	-0.	4.0600	72.750	4.4300	-0.	-0.	-0.	-0.	-0.
266.00	1.1000	3.0000	4.3800	51.130	3.9400	-0.	2.7900	40.500	3.2900	-0.	2.9000	30.880	4.4500	-0.
266.00	1.2000	3.0000	5.0600	56.390	3.4900	-0.	2.8600	12.650	3.5400	-0.	-0.	-0.	-0.	-0.
267.00	1.1000	9.0000	5.3300	50.380	4.8700	-0.	2.7700	35.570	3.5200	-0.	3.3400	40.310	4.3200	-0.
267.00	1.2000	9.0000	6.2400	45.970	4.6900	-0.	3.9800	35.620	3.4600	-0.	-0.	-0.	-0.	-0.
268.00	1.1000	9.0000	3.8500	68.760	6.3800	-0.	3.1100	56.350	5.5100	-0.	3.4600	60.440	6.6000	-0.
268.00	1.2000	9.0000	5.7400	84.650	9.2300	-0.	3.6800	44.620	7.2400	-0.	-0.	-0.	-0.	-0.
269.00	1.1000	9.0000	4.7600	50.090	6.5200	-0.	3.5600	41.460	4.4600	-0.	4.0900	40.240	6.5500	-0.
269.00	1.2000	9.0000	5.2300	62.540	9.8800	-0.	3.7300	44.460	4.1100	-0.	-0.	-0.	-0.	-0.
270.00	1.1000	7.0000	4.6300	50.130	8.8400	-0.	3.2700	35.500	6.5700	-0.	3.6400	45.940	7.2100	-0.
270.00	1.2000	7.0000	5.0500	40.750	10.430	-0.	2.9900	14.850	8.7800	-0.	-0.	-0.	-0.	-0.
271.00	1.1000	4.0000	2.7300	25.080	6.4100	-0.	2.3200	23.740	6.2300	-0.	2.9400	20.160	9.2800	-0.
271.00	1.2000	4.0000	2.7200	28.230	6.5300	-0.	1.9200	17.870	4.5800	-0.	-0.	-0.	-0.	-0.
272.00	1.1000	8.0000	6.4200	90.840	8.3200	-0.	4.7100	53.370	6.9500	-0.	4.9600	48.910	9.2600	-0.
272.00	1.2000	8.0000	5.6000	53.350	9.7800	-0.	4.0200	26.660	7.7600	-0.	-0.	-0.	-0.	-0.
273.00	1.1000	8.0000	6.7700	128.81	6.6200	-0.	4.7100	106.66	4.4600	-0.	5.6000	109.26	7.5100	-0.
273.00	1.2000	8.0000	5.2200	135.76	2.7600	-0.	1.9900	71.230	2.8200	-0.	-0.	-0.	-0.	-0.
274.00	1.1000	9.0000	7.8700	59.430	8.7300	-0.	8.2500	47.510	5.5100	-0.	11.470	46.100	6.3700	-0.
274.00	1.2000	9.0000	6.1300	71.880	6.6300	-0.	4.2200	53.210	4.2800	-0.	-0.	-0.	-0.	-0.
275.00	1.1000	9.0000	4.8300	[illegible]	5.7500	-0.	2.8900	26.720	4.1100	-0.	3.4200	25.930	6.2300	-0.
275.00	1.2000	9.0000	6.1100	[illegible]	8.8700	-0.	4.9100	26.680	6.4900	-0.	-0.	-0.	-0.	-0.
276.00	1.1000	12.000	4.5500	56.620	3.8600	-0.	2.9700	29.720	3.1400	-0.	3.8100	40.380	3.4500	-0.
276.00	1.2000	12.000	6.1000	59.690	3.8200	-0.	2.9100	32.660	3.2200	-0.	-0.	-0.	-0.	-0.
277.00	1.1000	3.0000	5.4200	46.870	9.7600	-0.	3.7800	17.770	7.6100	-0.	4.3000	17.750	11.590	-0.
277.00	1.2000	3.0000	4.9200	63.770	1.6100	-0.	2.5900	32.640	6.9900	-0.	-0.	-0.	-0.	-0.
278.00	1.1000	3.0000	8.0300	81.570	5.7200	-0.	6.7100	56.310	4.5200	-0.	7.4900	54.650	6.0600	-0.
278.00	1.2000	3.0000	11.170	115.90	5.3700	-0.	6.8900	50.510	4.2700	-0.	-0.	-0.	-0.	-0.
279.00	1.1000	1.0000	5.0800	59.620	7.7100	-0.	2.9900	41.420	4.4300	-0.	3.9200	54.550	7.1000	-0.
279.00	1.2000	1.0000	5.7300	69.310	6.3100	-0.	3.4200	38.610	4.9100	-0.	-0.	-0.	-0.	-0.
280.00	1.1000	8.0000	13.900	120.84	5.2100	-0.	4.0200	26.540	5.0200	-0.	5.5600	40.070	5.7700	-0.
280.00	1.2000	8.0000	8.2000	201.38	2.9700	-0.	9.1200	177.13	1.8400	-0.	-0.	-0.	-0.	-0.
281.00	1.1000	3.0000	4.2100	51.790	3.8700	-0.	2.1000	38.530	3.2400	-0.	2.4600	46.020	3.6500	-0.
281.00	1.2000	3.0000	7.2100	97.050	5.1500	-0.	3.1800	47.490	3.5700	-0.	-0.	-0.	-0.	-0.
282.00	1.1000	4.0000	5.1500	75.050	5.8800	-0.	4.2700	62.290	5.6300	-0.	5.7700	60.440	5.7000	-0.
282.00	1.2000	4.0000	5.1400	87.770	4.4900	-0.	3.8800	65.440	3.2100	-0.	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
283.00	1.1000	10.000	3.6800	40.710	10.430	-0.	2.5100	26.630	9.8100	-0.	3.6300	34.450	9.8700	-0.
283.00	1.2000	10.000	5.6500	81.690	9.7100	-0.	3.0700	14.860	7.8700	-0.	-0.	-0.	-0.	-0.
284.00	1.1000	10.000	52.900	68.940	12.860	-0.	3.4700	47.510	8.0400	-0.	4.6500	51.870	11.820	-0.
284.00	1.2000	10.000	5.2800	72.250	9.8100	-0.	3.5300	49.070	6.4400	-0.	-0.	-0.	-0.	-0.
285.00	1.1000	4.0000	4.6500	47.590	8.8400	-0.	2.6400	26.720	6.0200	-0.	2.7700	31.700	8.4300	-0.
285.00	1.2000	4.0000	5.0500	72.030	8.0400	-0.	3.1900	29.720	6.6500	-0.	-0.	-0.	-0.	-0.
286.00	1.1000	1.0000	5.1700	58.610	4.3600	-0.	3.0000	71.210	2.7200	-0.	3.7500	109.42	2.6900	-0.
286.00	1.2000	1.0000	4.7600	75.510	4.8200	-0.	2.7300	50.460	3.1800	-0.	-0.	-0.	-0.	-0.
287.00	1.1000	10.000	6.4900	151.22	3.3200	-0.	2.7800	89.040	3.5800	-0.	3.9800	103.69	4.2400	-0.
287.00	1.2000	10.000	6.3000	153.35	2.9900	-0.	2.9700	44.550	3.7800	-0.	-0.	-0.	-0.	-0.
288.00	1.1000	10.000	4.4600	31.510	8.1800	-0.	3.1800	20.750	5.6700	-0.	3.6400	14.390	8.0100	-0.
288.00	1.2000	10.000	5.3600	47.030	8.2600	-0.	3.9700	38.630	5.6400	-0.	-0.	-0.	-0.	-0.
289.00	1.1000	3.0000	9.2900	109.91	4.8900	-0.	4.2900	44.540	3.9600	-0.	4.9300	40.340	6.5700	-0.
289.00	1.2000	3.0000	6.6600	99.940	5.3900	-0.	3.5900	44.440	4.2500	-0.	-0.	-0.	-0.	-0.
290.00	1.1000	1.0000	5.1300	84.520	10.620	-0.	3.5100	29.540	9.5200	-0.	4.0500	40.140	10.380	-0.
290.00	1.2000	1.0000	5.8500	97.060	8.1300	-0.	3.6700	29.600	6.7200	-0.	-0.	-0.	-0.	-0.
291.00	1.1000	3.0000	9.5700	120.75	6.1000	-0.	6.8700	82.510	5.9400	-0.	9.2200	97.240	7.0600	-0.
291.00	1.2000	3.0000	6.1600	89.250	5.1100	-0.	3.5500	37.960	5.2400	-0.	-0.	-0.	-0.	-0.
292.00	1.1000	3.0000	6.7500	118.76	7.7000	-0.	3.5800	62.080	2.3200	-0.	5.9000	60.250	4.9500	-0.
292.00	1.2000	3.0000	7.0700	121.53	4.9700	-0.	3.1400	62.060	3.3400	-0.	-0.	-0.	-0.	-0.
293.00	1.1000	7.0000	7.9500	161.90	3.0400	-0.	4.0200	50.110	5.0000	-0.	4.7100	54.360	6.6400	-0.
293.00	1.2000	7.0000	8.5200	158.28	3.1900	-0.	3.0000	26.720	3.7700	-0.	-0.	-0.	-0.	-0.
294.00	1.1000	7.0000	3.9300	69.020	7.8000	-0.	2.3800	32.570	6.2700	-0.	2.5300	34.480	7.7600	-0.
294.00	1.2000	7.0000	4.3200	87.070	6.1500	-0.	2.9700	59.040	4.7900	-0.	-0.	-0.	-0.	-0.
295.00	1.1000	6.0000	11.570	128.78	5.9800	-0.	5.0700	101.26	4.8800	-0.	5.6800	87.130	8.0400	-0.
295.00	1.2000	6.0000	7.8700	54.200	11.750	-0.	3.9500	33.890	7.4000	-0.	-0.	-0.	-0.	-0.
296.00	1.1000	9.0000	5.0600	77.120	5.2300	-0.	3.2700	42.840	4.3200	-0.	4.3700	55.330	5.7100	-0.
296.00	1.2000	9.0000	4.4800	45.410	6.0200	-0.	3.7700	28.990	4.4100	-0.	-0.	-0.	-0.	-0.
297.00	1.1000	9.0000	3.3800	46.350	10.000	-0.	2.5900	17.570	6.3600	-0.	2.7700	17.060	8.0400	-0.
297.00	1.2000	9.0000	3.7700	58.330	9.9000	-0.	2.3300	17.580	8.0700	-0.	-0.	-0.	-0.	-0.
298.00	1.1000	4.0000	4.5900	77.190	6.2400	-0.	3.1200	49.970	4.2700	-0.	4.2900	53.310	6.1900	-0.
298.00	1.2000	4.0000	5.1500	95.050	5.4200	-0.	3.1500	49.900	3.8800	-0.	-0.	-0.	-0.	-0.
299.00	1.1000	4.0000	2.9500	49.640	3.3600	-0.	1.5300	35.210	1.9500	-0.	3.1300	34.170	4.0300	-0.
299.00	1.2000	4.0000	4.3500	85.290	5.1100	-0.	3.2900	69.700	3.4100	-0.	-0.	-0.	-0.	-0.
300.00	1.1000	4.0000	5.3200	126.61	4.6700	-0.	4.3100	120.83	2.8700	-0.	5.0600	123.18	4.5700	-0.
300.00	1.2000	4.0000	4.8100	70.490	5.4200	-0.	3.2900	42.820	3.9000	-0.	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			6.7444	83.711	6.4153	0.	4.1725	45.416	4.7986	0.	5.8259	53.280	6.4091	0.
ESTIMATE OF STANDARD DEVIATION			4.3749	40.877	2.4860	-0.	2.7550	30.635	1.9729	-0.	4.7225	33.387	2.5013	-0.
DEGREES OF FREEDOM			299	299	299	0	299	299	299	0	149	149	149	0
T VALUE			26.702	35.470	44.734	-0.	26.232	25.677	42.128	-0.	15.109	19.545	31.382	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
151.00	2.0000	7.0000	3.5400	50.090	5.4800	5.5600	2.5700	26.420	4.4600	4.5800	-0.	-0.	-0.	-0.
152.00	2.0000	3.0000	8.8400	127.47	1.7200	1.5900	1.0900	41.130	1.0000	.48000	-0.	-0.	-0.	-0.
153.00	2.0000	3.0000	5.2900	77.690	7.1400	6.3000	3.9200	47.590	5.2400	4.8400	-0.	-0.	-0.	-0.
154.00	2.0000	1.0000	4.6300	100.62	-0.	2.3700	3.3300	86.830	-0.	1.1800	-0.	-0.	-0.	-0.
155.00	2.0000	4.0000	5.0600	93.730	4.3700	4.2600	4.5300	74.930	2.9000	2.8400	-0.	-0.	-0.	-0.
156.00	2.0000	9.0000	4.7400	33.770	9.1400	8.2300	3.2100	15.790	6.5300	6.4500	-0.	-0.	-0.	-0.
157.00	2.0000	3.0000	4.5300	42.870	7.9700	7.1600	2.7300	20.350	5.3300	5.0300	-0.	-0.	-0.	-0.
158.00	2.0000	12.000	4.9300	45.390	4.1900	4.0100	3.3300	26.090	2.6400	2.6800	-0.	-0.	-0.	-0.
159.00	2.0000	9.0000	3.8000	54.560	6.2200	6.0400	2.5400	39.290	4.3600	4.2300	-0.	-0.	-0.	-0.
160.00	2.0000	3.0000	8.5900	93.610	3.9100	3.7300	5.0700	29.890	3.3500	3.3900	-0.	-0.	-0.	-0.
161.00	2.0000	12.000	4.9000	62.990	6.8100	5.9500	3.1500	29.220	4.4700	4.4300	-0.	-0.	-0.	-0.
162.00	2.0000	3.0000	4.0500	30.370	-0.	7.5300	2.9600	21.370	-0.	6.5900	-0.	-0.	-0.	-0.
163.00	2.0000	9.0000	5.9800	116.00	-0.	3.7100	4.2600	76.240	-0.	2.5800	-0.	-0.	-0.	-0.
164.00	2.0000	13.000	10.050	98.940	-0.	2.4900	6.6400	94.410	-0.	1.0100	-0.	-0.	-0.	-0.
165.00	2.0000	7.0000	6.4900	114.56	-0.	6.1400	4.2000	61.430	-0.	5.6600	-0.	-0.	-0.	-0.
166.00	2.0000	2.0000	20.480	245.27	-0.	3.8000	30.230	262.31	-0.	1.4500	-0.	-0.	-0.	-0.
167.00	2.0000	1.0000	8.7800	137.05	-0.	7.5000	4.9500	58.160	-0.	4.5400	-0.	-0.	-0.	-0.
168.00	2.0000	7.0000	11.260	181.72	-0.	4.5700	6.8600	118.16	-0.	3.2400	-0.	-0.	-0.	-0.
169.00	2.0000	5.0000	5.6200	49.760	-0.	5.1900	5.0900	26.020	-0.	4.4900	-0.	-0.	-0.	-0.
170.00	2.0000	5.0000	4.9700	72.450	-0.	2.8900	3.1700	27.980	-0.	2.4400	-0.	-0.	-0.	-0.
171.00	2.0000	7.0000	12.940	199.59	-0.	1.3800	7.8600	137.65	-0.	1.3500	-0.	-0.	-0.	-0.
172.00	2.0000	5.0000	8.1000	121.06	-0.	5.1100	5.1600	62.320	-0.	4.4800	-0.	-0.	-0.	-0.
173.00	2.0000	2.0000	5.0200	98.870	-0.	5.2100	3.2000	59.770	-0.	3.6500	-0.	-0.	-0.	-0.
174.00	2.0000	12.000	6.8200	61.940	-0.	3.1800	3.9800	41.620	-0.	2.3200	-0.	-0.	-0.	-0.
175.00	2.0000	11.000	12.240	152.68	-0.	2.8600	4.6800	50.720	-0.	4.1400	-0.	-0.	-0.	-0.
176.00	2.0000	8.0000	9.1700	164.38	-0.	3.4800	4.3900	51.210	-0.	2.7900	-0.	-0.	-0.	-0.
177.00	2.0000	3.0000	8.8000	125.20	-0.	4.6200	3.5900	58.040	-0.	4.1000	-0.	-0.	-0.	-0.
178.00	2.0000	1.0000	6.9700	90.610	-0.	3.6300	4.6900	58.020	-0.	2.4600	-0.	-0.	-0.	-0.
179.00	2.0000	8.0000	7.8400	93.930	-0.	6.3600	3.7600	9.1100	-0.	5.9000	-0.	-0.	-0.	-0.
180.00	2.0000	3.0000	8.0700	106.21	-0.	5.8300	3.8300	42.230	-0.	3.9000	-0.	-0.	-0.	-0.
181.00	2.0000	2.0000	3.8500	96.150	-0.	4.4500	2.1500	75.760	-0.	1.7100	-0.	-0.	-0.	-0.
182.00	2.0000	3.0000	6.5400	96.980	-0.	7.7200	4.3400	51.270	-0.	6.4100	-0.	-0.	-0.	-0.
183.00	2.0000	3.0000	7.0700	91.830	-0.	5.5200	4.9100	43.480	-0.	4.6500	-0.	-0.	-0.	-0.
184.00	2.0000	3.0000	8.0800	132.17	-0.	4.4300	5.4600	81.300	-0.	2.3800	-0.	-0.	-0.	-0.
185.00	2.0000	2.0000	5.9400	118.12	8.1400	7.2100	3.7600	52.240	6.9500	6.3900	-0.	-0.	-0.	-0.
186.00	2.0000	3.0000	2.4600	51.280	6.0900	5.6800	1.1800	29.520	2.9800	2.7200	-0.	-0.	-0.	-0.
187.00	2.0000	9.0000	8.7700	128.92	4.4300	3.8700	3.7400	33.050	3.4700	5.3800	-0.	-0.	-0.	-0.
190.00	2.0000	9.0000	8.8100	160.46	6.2200	5.6300	3.2400	49.670	4.5400	4.2500	-0.	-0.	-0.	-0.
191.00	2.0000	7.0000	5.9600	87.960	6.3200	5.7700	3.3300	38.340	4.1500	3.9800	-0.	-0.	-0.	-0.
193.00	2.0000	9.0000	4.6300	40.610	3.7400	3.8800	2.8300	11.490	2.6600	2.8300	-0.	-0.	-0.	-0.
194.00	2.0000	12.000	16.280	123.54	2.8900	2.8900	10.470	94.970	1.6400	1.5500	-0.	-0.	-0.	-0.
196.00	2.0000	9.0000	7.3600	77.760	7.0000	-0.	3.0700	15.100	5.7700	-0.	-0.	-0.	-0.	-0.
197.00	2.0000	8.0000	23.020	344.58	1.0300	-0.	10.730	192.91	.87000	-0.	-0.	-0.	-0.	-0.
198.00	2.0000	12.000	5.6200	60.150	3.5600	3.7400	2.5800	42.310	2.5000	2.4200	-0.	-0.	-0.	-0.
199.00	2.0000	13.000	4.6500	57.540	4.4500	4.0000	2.7200	47.970	2.8400	2.6700	-0.	-0.	-0.	-0.
200.00	2.0000	12.000	7.1700	66.600	2.9200	-0.	3.2000	37.070	1.8700	-0.	-0.	-0.	-0.	-0.
202.00	2.0000	9.0000	4.2800	29.830	10.580	8.9000	3.1900	6.9700	5.9300	5.7900	-0.	-0.	-0.	-0.
204.00	2.0000	1.0000	9.2300	180.21	5.3500	-0.	3.2300	171.79	4.1100	-0.	-0.	-0.	-0.	-0.
205.00	2.0000	8.0000	10.320	171.51	4.5800	4.5400	5.2600	85.210	3.4100	3.4600	-0.	-0.	-0.	-0.
206.00	2.0000	9.0000	6.7900	86.150	6.7200	-0.	3.4600	41.910	4.4000	-0.	-0.	-0.	-0.	-0.
207.00	2.0000	4.0000	7.8400	143.95	2.8200	3.0400	3.2700	58.500	2.2300	2.2700	-0.	-0.	-0.	-0.
208.00	2.0000	9.0000	5.0933	60.989	4.5853	4.5520	2.9600	20.180	3.9400	4.0200	-0.	-0.	-0.	-0.
209.00	2.0000	4.0000	16.320	104.90	5.5000	5.2400	12.780	22.100	5.0900	4.9600	-0.	-0.	-0.	-0.
210.00	2.0000	3.0000	6.2800	81.060	5.0000	4.7900	3.3500	17.040	3.7200	3.8800	-0.	-0.	-0.	-0.
211.00	2.0000	7.0000	7.9700	124.28	5.3900	4.8700	5.4500	92.680	3.1700	3.1300	-0.	-0.	-0.	-0.
213.00	2.0000	4.0000	7.5300	124.56	5.6200	5.2100	2.8600	18.380	4.6100	4.5200	-0.	-0.	-0.	-0.
214.00	2.0000	3.0000	9.1600	140.61	7.4000	5.3700	4.0100	54.540	5.2400	3.7800	-0.	-0.	-0.	-0.
215.00	2.0000	8.0000	6.0300	102.23	7.2200	6.3400	3.2000	33.010	6.3100	5.8900	-0.	-0.	-0.	-0.
216.00	2.0000	9.0000	6.0300	74.750	7.7000	6.9200	2.9000	14.840	5.0900	5.2200	-0.	-0.	-0.	-0.
217.00	2.0000	3.0000	4.0100	49.010	3.9300	3.1200	3.1100	13.600	6.2500	5.7900	-0.	-0.	-0.	-0.
218.00	2.0000	5.0000	5.4900	90.090	5.2900	5.3400	2.6600	41.870	3.9800	4.1100	-0.	-0.	-0.	-0.
219.00	2.0000	9.0000	5.8700	97.990	4.2100	3.5800	3.2800	68.550	2.1100	1.7000	-0.	-0.	-0.	-0.
220.00	2.0000	5.0000	7.7800	107.45	6.1700	5.7200	3.6900	41.670	4.1600	4.2000	-0.	-0.	-0.	-0.
221.00	2.0000	9.0000	5.0200	67.100	4.4100	4.0200	3.6900	35.680	3.0100	2.7600	-0.	-0.	-0.	-0.
222.00	2.0000	12.000	4.7900	51.330	5.6700	5.4400	1.8900	20.990	4.0500	3.9600	-0.	-0.	-0.	-0.
223.00	2.0000	5.0000	5.9700	123.63	5.7600	5.3500	4.0600	62.250	3.7400	3.7400	-0.	-0.	-0.	-0.

39

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CHC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOAP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
224.00	2.0000	3.0000	4.1300	46.960	4.2900	4.1900	2.5600	27.940	3.2500	3.2100	-0.	-0.	-0.	-0.
225.00	2.0000	5.0000	6.1000	88.280	4.7400	4.3000	3.9900	47.970	3.2200	3.1800	-0.	-0.	-0.	-0.
226.00	2.0000	5.0000	4.8700	56.270	4.5400	4.4100	2.4100	39.070	3.5600	3.4800	-0.	-0.	-0.	-0.
227.00	2.0000	3.0000	6.5200	61.180	10.710	8.8600	4.2100	39.080	6.1600	5.9900	-0.	-0.	-0.	-0.
228.00	2.0000	7.0000	4.6100	88.030	5.6000	5.2800	2.8500	46.790	3.9100	4.0000	-0.	-0.	-0.	-0.
229.00	2.0000	9.0000	5.2400	62.990	7.9400	6.9300	2.5700	20.830	5.2600	4.8900	-0.	-0.	-0.	-0.
231.00	2.0000	6.0000	7.0700	112.67	6.6800	5.7200	1.6400	26.380	2.1500	2.0400	-0.	-0.	-0.	-0.
232.00	2.0000	8.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
233.00	2.0000	10.000	6.1300	93.710	6.3500	5.3200	3.8100	51.040	4.4300	3.9600	-0.	-0.	-0.	-0.
234.00	2.0000	5.0000	4.9800	31.460	5.3700	4.5900	3.0900	7.6700	3.8400	3.5300	-0.	-0.	-0.	-0.
235.00	2.0000	1.0000	3.1700	65.870	6.6500	6.0800	1.7400	26.850	3.5900	3.6400	-0.	-0.	-0.	-0.
236.00	2.0000	3.0000	5.0000	65.580	5.9000	-0.	2.8800	23.140	4.5800	-0.	-0.	-0.	-0.	-0.
237.00	2.0000	3.0000	6.0600	55.100	5.5400	5.1900	3.1200	14.770	3.7800	3.8700	-0.	-0.	-0.	-0.
238.00	2.0000	8.0000	5.7400	82.910	4.5000	4.2400	2.6700	41.770	3.4800	3.4800	-0.	-0.	-0.	-0.
239.00	2.0000	3.0000	5.7000	81.990	4.3500	4.2200	4.0900	46.980	3.5600	3.7300	-0.	-0.	-0.	-0.
240.00	2.0000	12.000	15.990	111.20	1.7200	1.9800	8.0900	76.710	1.1000	1.1400	-0.	-0.	-0.	-0.
241.00	2.0000	9.0000	5.8500	115.01	3.4500	3.6700	2.8500	58.240	1.8200	2.2400	-0.	-0.	-0.	-0.
242.00	2.0000	9.0000	5.6400	66.200	3.3600	3.1800	2.7500	31.720	2.0500	1.8800	-0.	-0.	-0.	-0.
245.00	2.0000	7.0000	8.6000	115.02	5.0200	4.5400	4.7300	60.690	4.8800	4.4200	-0.	-0.	-0.	-0.
246.00	2.0000	3.0000	-0.	-0.	-0.	-0.	1.6700	15.880	2.6900	2.1800	-0.	-0.	-0.	-0.
247.00	2.0000	3.0000	3.1800	46.440	2.8200	2.6100	2.0100	23.290	1.8000	1.5600	-0.	-0.	-0.	-0.
248.00	2.0000	3.0000	6.6000	113.70	2.9000	3.1600	4.5400	63.700	2.8200	2.7000	-0.	-0.	-0.	-0.
250.00	2.0000	3.0000	6.9600	100.47	4.6100	3.6800	3.7000	45.990	3.5300	2.8200	-0.	-0.	-0.	-0.
251.00	2.0000	9.0000	5.9400	85.890	6.0600	4.7800	3.7200	32.770	5.8300	4.6900	-0.	-0.	-0.	-0.
252.00	2.0000	12.000	3.5400	61.760	3.3600	3.2400	2.8200	31.060	2.7100	2.5600	-0.	-0.	-0.	-0.
254.00	2.0000	3.0000	6.5700	97.200	8.2200	6.7300	4.0000	41.890	5.6500	5.1600	-0.	-0.	-0.	-0.
255.00	2.0000	3.0000	4.5800	69.270	3.3500	3.3000	2.8200	36.700	2.9200	2.5800	-0.	-0.	-0.	-0.
256.00	2.0000	1.0000	3.9300	91.690	3.7000	3.3300	2.2000	35.540	3.6300	2.9400	-0.	-0.	-0.	-0.
257.00	2.0000	3.0000	6.7100	85.070	3.7400	3.6900	4.5500	66.040	3.1700	2.8600	-0.	-0.	-0.	-0.
258.00	2.0000	9.0000	6.3300	86.360	6.2100	5.4300	3.2800	28.490	4.4900	4.1400	-0.	-0.	-0.	-0.
259.00	2.0000	9.0000	9.7000	97.410	7.5900	5.6800	5.2900	63.490	5.8700	4.8100	-0.	-0.	-0.	-0.
260.00	2.0000	8.0000	4.1300	67.200	5.0700	4.5200	2.4600	25.090	4.1500	3.8300	-0.	-0.	-0.	-0.
261.00	2.0000	1.0000	6.5300	118.75	6.3400	6.2600	3.7500	57.540	5.3700	5.2800	-0.	-0.	-0.	-0.
262.00	2.0000	5.0000	10.610	140.02	2.9600	3.1400	4.5900	55.480	3.4900	3.4500	-0.	-0.	-0.	-0.
263.00	2.0000	11.000	4.2300	37.440	5.1800	4.5000	2.2000	53.120	3.8900	3.5300	-0.	-0.	-0.	-0.
265.00	2.0000	9.0000	7.0900	117.38	4.0700	3.9400	4.2300	58.200	3.9700	3.9700	-0.	-0.	-0.	-0.
267.00	2.0000	9.0000	5.8900	46.360	5.1600	4.9100	3.3700	22.890	4.1700	4.3200	-0.	-0.	-0.	-0.
268.00	2.0000	9.0000	6.6000	104.11	7.1400	6.3200	4.1000	55.580	5.4100	5.2600	-0.	-0.	-0.	-0.
269.00	2.0000	9.0000	5.6600	79.300	3.8400	4.2100	3.8600	38.250	3.6700	4.1200	-0.	-0.	-0.	-0.
270.00	2.0000	7.0000	3.8500	32.760	9.5200	8.4700	1.8900	5.9000	7.6000	7.6800	-0.	-0.	-0.	-0.
271.00	2.0000	4.0000	5.2400	43.280	8.3600	8.5500	2.7000	24.230	4.8100	5.7400	-0.	-0.	-0.	-0.
272.00	2.0000	8.0000	6.0700	78.280	7.4800	7.0000	3.3800	19.460	6.9700	6.8300	-0.	-0.	-0.	-0.
273.00	2.0000	8.0000	5.8000	61.920	6.8800	6.1200	3.3100	25.600	4.8800	4.6800	-0.	-0.	-0.	-0.
274.00	2.0000	9.0000	5.6700	64.980	5.4100	4.5400	3.9900	46.400	3.5000	3.2600	-0.	-0.	-0.	-0.
275.00	2.0000	9.0000	7.0600	49.220	8.2400	7.6500	4.8500	11.920	7.2200	7.2200	-0.	-0.	-0.	-0.
277.00	2.0000	3.0000	9.9000	135.74	5.2800	6.2900	4.2700	21.980	6.5100	7.8500	-0.	-0.	-0.	-0.
278.00	2.0000	3.0000	11.340	105.48	4.3600	4.3200	6.5400	42.490	3.7500	3.8800	-0.	-0.	-0.	-0.
279.00	2.0000	1.0000	8.5600	96.170	5.2200	4.8000	4.9400	53.220	3.9200	3.6600	-0.	-0.	-0.	-0.
280.00	2.0000	8.0000	8.7333	167.21	2.4253	2.1800	5.8700	127.09	1.4800	1.5200	-0.	-0.	-0.	-0.
281.00	2.0000	3.0000	7.0100	80.230	4.7500	4.2900	3.1900	32.870	3.8000	3.5300	-0.	-0.	-0.	-0.
282.00	2.0000	4.0000	6.4800	121.10	4.6500	5.2400	4.0900	82.610	2.3800	3.0400	-0.	-0.	-0.	-0.
283.00	2.0000	10.000	5.1500	75.870	7.4200	6.6400	2.6000	20.720	6.5900	5.9500	-0.	-0.	-0.	-0.
284.00	2.0000	10.000	5.1400	63.420	3.4600	7.8100	2.6500	37.230	5.8500	5.7000	-0.	-0.	-0.	-0.
285.00	2.0000	4.0000	4.7100	90.620	7.0500	6.1900	2.9000	31.930	5.4800	5.1200	-0.	-0.	-0.	-0.
286.00	2.0000	1.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
287.00	2.0000	10.000	14.175	132.19	3.2387	3.2480	2.3800	33.210	3.9300	3.9700	-0.	-0.	-0.	-0.
288.00	2.0000	10.000	6.7000	89.110	5.6400	4.9300	4.8700	68.520	3.4800	3.3900	-0.	-0.	-0.	-0.
289.00	2.0000	3.0000	10.740	126.87	4.3900	4.1700	3.3800	35.720	3.7000	3.5700	-0.	-0.	-0.	-0.
290.00	2.0000	1.0000	6.6613	95.964	6.5120	6.1987	4.5400	50.000	5.1700	5.2100	-0.	-0.	-0.	-0.
291.00	2.0000	3.0000	5.0280	99.593	4.6667	4.7347	4.3100	45.020	5.4200	5.1600	-0.	-0.	-0.	-0.
292.00	2.0000	3.0000	18.207	165.00	2.8027	3.0427	3.2400	58.000	2.9100	2.7400	-0.	-0.	-0.	-0.
293.00	2.0000	7.0000	9.1147	150.97	2.8947	2.9933	3.0900	26.910	4.7400	4.7300	-0.	-0.	-0.	-0.
294.00	2.0000	7.0000	4.4133	74.681	4.9173	5.1653	2.4600	35.520	4.3200	4.1200	-0.	-0.	-0.	-0.
295.00	2.0000	3.0000	14.165	110.42	7.9320	7.1813	3.9300	9.1200	7.4100	7.6600	-0.	-0.	-0.	-0.
296.00	2.0000	9.0000	6.2840	44.883	5.3000	5.2720	3.2600	18.920	4.1600	4.4500	-0.	-0.	-0.	-0.
297.00	2.0000	9.0000	3.6853	45.032	6.4027	6.0093	1.9100	12.550	5.0700	5.0700	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
298.00	2.0000	4.0000	5.1480	68.400	5.0267	4.9053	2.7800	34.970	3.4500	3.5300	-0.	-0.	-0.	-0.
299.00	2.0000	4.0000	4.9000	81.391	3.9520	3.8667	2.7900	50.740	2.5300	2.6100	-0.	-0.	-0.	-0.
300.00	2.0000	4.0000	3.8137	65.904	3.4453	3.4880	2.5800	48.850	2.2800	2.1500	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			7.0844	94.333	5.3184	4.9146	3.9615	46.781	4.0572	3.8827	0.	0.	0.	0.
ESTIMATE OF STANDARD DEVIATION			3.5698	44.167	1.8517	1.5670	2.8313	34.794	1.4591	1.4944	-0.	-0.	-0.	-0.
DEGREES OF FREEDOM			131	131	107	125	132	132	108	126	0	0	0	0
T VALUE			22.801	24.538	29.849	35.204	16.136	15.505	29.033	29.280	-0.	-0.	-0.	-0.

HI

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 2 TEST 3

TABULATION OF CMC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
151.00	3.0000	7.0000	3.1227	48.231	3.5960	3.2973	1.9300	22.050	3.0100	2.5800	-0.	-0.	-0.	-0.
153.00	3.0000	3.0000	8.5120	93.055	4.9947	4.7853	6.3900	57.640	3.6100	3.5000	-0.	-0.	-0.	-0.
154.00	3.0000	1.0000	4.5520	94.023	3.0360	2.6733	3.4600	80.480	1.3800	1.3800	-0.	-0.	-0.	-0.
155.00	3.0000	4.0000	5.4707	95.011	2.3253	2.1560	4.3600	68.150	1.8600	1.5900	-0.	-0.	-0.	-0.
156.00	3.0000	9.0000	4.3933	39.808	7.9253	6.6000	2.9700	17.380	7.0700	6.1200	-0.	-0.	-0.	-0.
157.00	3.0000	3.0000	4.1413	56.244	4.7893	4.2360	2.8600	23.770	4.6000	4.1000	-0.	-0.	-0.	-0.
159.00	3.0000	9.0000	4.7560	52.193	4.1653	4.0427	2.0000	25.970	3.5600	3.2700	-0.	-0.	-0.	-0.
160.00	3.0000	3.0000	4.1853	115.40	2.7307	2.6173	5.0600	43.190	2.7700	2.3400	-0.	-0.	-0.	-0.
161.00	3.0000	12.000	4.3253	49.069	5.2933	4.4560	2.6400	28.640	3.7300	3.2700	-0.	-0.	-0.	-0.
162.00	3.0000	3.0000	4.3880	38.437	5.1880	4.5200	3.1200	24.030	5.0500	4.4800	-0.	-0.	-0.	-0.
163.00	3.0000	9.0000	3.3400	50.161	1.6320	1.4253	2.3300	37.780	1.5200	1.1700	-0.	-0.	-0.	-0.
166.00	3.0000	2.0000	11.413	189.33	3.7973	3.6333	13.260	198.42	2.3600	2.0900	-0.	-0.	-0.	-0.
168.00	3.0000	7.0000	7.3720	134.96	2.5427	2.2653	5.2600	100.62	1.8600	1.7300	-0.	-0.	-0.	-0.
169.00	3.0000	5.0000	9.2093	61.457	5.5080	4.8480	4.6200	28.970	4.0300	3.7200	-0.	-0.	-0.	-0.
173.00	3.0000	2.0000	3.4920	60.635	5.3253	5.0067	2.4400	36.540	4.3600	4.0000	-0.	-0.	-0.	-0.
174.00	3.0000	12.000	14.196	102.15	1.8120	1.5320	13.290	98.700	1.3600	.92000	-0.	-0.	-0.	-0.
175.00	3.0000	11.000	8.2347	113.19	2.3000	2.2240	3.7400	48.220	2.9300	2.7300	-0.	-0.	-0.	-0.
176.00	3.0000	8.0000	7.7307	126.07	4.3787	3.8440	3.6500	55.510	9.6000	8.5900	-0.	-0.	-0.	-0.
177.00	3.0000	3.0000	5.3600	97.739	3.3547	5.0013	2.2400	51.240	2.6400	3.4500	-0.	-0.	-0.	-0.
178.00	3.0000	1.0000	5.0867	75.081	2.8480	2.4840	4.4000	57.320	2.3800	2.0200	-0.	-0.	-0.	-0.
179.00	3.0000	8.0000	3.6187	18.785	6.0293	3.9347	2.7300	4.4400	4.3600	3.8500	-0.	-0.	-0.	-0.
181.00	3.0000	2.0000	6.9880	142.82	2.6987	2.5387	6.0600	124.70	1.6600	1.4500	-0.	-0.	-0.	-0.
182.00	3.0000	3.0000	5.7013	82.403	5.4227	4.3853	4.0200	52.640	4.1600	3.4900	-0.	-0.	-0.	-0.
183.00	3.0000	3.0000	5.0933	56.837	3.0880	3.2827	3.8000	36.010	3.0600	2.7000	-0.	-0.	-0.	-0.
185.00	3.0000	-0.	4.6693	91.703	6.4293	5.8387	3.4000	51.730	6.7500	5.5800	-0.	-0.	-0.	-0.
186.00	3.0000	3.0000	4.5133	47.971	4.9443	4.0560	1.4800	24.480	2.8000	2.3400	-0.	-0.	-0.	-0.
187.00	3.0000	9.0000	4.5133	63.829	4.1467	3.9653	3.1200	23.060	5.0900	4.4700	-0.	-0.	-0.	-0.
190.00	3.0000	9.0000	4.4453	73.811	4.5960	3.7533	3.3000	45.790	4.6000	4.0600	-0.	-0.	-0.	-0.
191.00	3.0000	7.0000	11.887	112.43	4.2467	3.6227	3.1700	34.470	3.6700	3.1900	-0.	-0.	-0.	-0.
194.00	3.0000	12.000	11.632	67.939	2.4733	2.0520	9.6400	86.740	1.9000	1.3100	-0.	-0.	-0.	-0.
196.00	3.0000	9.0000	5.5267	62.987	4.3533	3.9267	2.9500	16.740	4.9000	4.0400	-0.	-0.	-0.	-0.
197.00	3.0000	8.0000	16.445	239.70	1.3747	1.00000	7.4200	106.40	2.3400	1.8400	-0.	-0.	-0.	-0.
200.00	3.0000	12.000	4.9107	46.871	3.0013	2.5547	4.1700	31.450	2.1300	1.8300	-0.	-0.	-0.	-0.
204.00	3.0000	1.0000	5.9680	118.33	6.8893	6.6400	3.7200	97.020	3.7300	3.2600	-0.	-0.	-0.	-0.
205.00	3.0000	8.0000	7.5760	125.95	6.3387	3.7400	5.9000	103.07	3.5500	3.0400	-0.	-0.	-0.	-0.
206.00	3.0000	9.0000	4.5627	64.184	5.1787	4.4933	2.6400	41.350	4.0000	3.4100	-0.	-0.	-0.	-0.
207.00	3.0000	4.0000	6.2733	114.62	2.6893	2.3147	2.5900	42.290	2.5300	2.0800	-0.	-0.	-0.	-0.
208.00	3.0000	9.0000	3.8440	45.493	4.1987	3.7533	2.3800	13.760	3.6200	3.2200	-0.	-0.	-0.	-0.
209.00	3.0000	4.0000	41.911	171.77	2.4107	2.2760	31.740	80.310	2.6300	2.1200	-0.	-0.	-0.	-0.
211.00	3.0000	7.0000	8.3107	124.05	5.3173	4.5667	6.8100	109.36	4.0000	3.2400	-0.	-0.	-0.	-0.
213.00	3.0000	4.0000	5.2093	92.283	5.1667	4.5160	3.1800	25.670	4.7400	4.1800	-0.	-0.	-0.	-0.
214.00	3.0000	3.0000	5.7493	110.08	-0.	5.3573	3.8200	54.650	-0.	4.9400	-0.	-0.	-0.	-0.
216.00	3.0000	9.0000	4.4467	42.491	7.5027	6.2867	2.8000	15.290	5.6500	4.7700	-0.	-0.	-0.	-0.
217.00	3.0000	3.0000	3.7720	29.080	6.4373	5.4533	2.9300	14.100	5.4900	4.7400	-0.	-0.	-0.	-0.
218.00	3.0000	5.0000	4.0920	66.421	5.5360	4.4707	2.7400	38.720	4.7300	3.8100	-0.	-0.	-0.	-0.
220.00	3.0000	5.0000	4.6653	82.607	5.5000	4.6960	3.2400	37.410	5.6600	4.8500	-0.	-0.	-0.	-0.
221.00	3.0000	9.0000	4.2960	69.784	4.0827	4.9627	3.2200	37.970	3.5000	3.0200	-0.	-0.	-0.	-0.
223.00	3.0000	5.0000	5.5067	117.63	4.5733	4.1013	3.3800	50.830	4.0900	3.5100	-0.	-0.	-0.	-0.
225.00	3.0000	5.0000	5.4040	98.413	4.8627	4.3813	4.5300	82.580	3.8900	3.3900	-0.	-0.	-0.	-0.
227.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
228.00	3.0000	7.0000	4.5133	90.615	5.1773	4.5440	2.9200	47.540	4.9800	4.3400	-0.	-0.	-0.	-0.
229.00	3.0000	9.0000	4.4853	63.481	6.7027	5.8720	2.2400	34.970	4.8200	4.1700	-0.	-0.	-0.	-0.
231.00	3.0000	6.0000	5.7053	119.25	3.5107	3.4013	3.8200	81.680	3.8200	3.2000	-0.	-0.	-0.	-0.
235.00	3.0000	1.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
236.00	3.0000	3.0000	5.1627	57.971	5.7147	5.1507	3.0000	22.630	5.5300	5.0800	-0.	-0.	-0.	-0.
238.00	3.0000	8.0000	5.6000	96.207	3.4603	3.0107	4.1200	52.920	13.630	4.5600	-0.	-0.	-0.	-0.
239.00	3.0000	-0.	4.4053	60.738	4.2613	4.4507	2.3600	33.550	5.3900	5.0400	-0.	-0.	-0.	-0.
240.00	3.0000	12.000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
241.00	3.0000	9.0000	4.4667	94.612	3.3680	3.1053	2.2500	55.150	2.8900	2.2300	-0.	-0.	-0.	-0.
242.00	3.0000	9.0000	5.8360	86.956	2.9680	2.8520	3.2700	49.560	1.9100	1.5600	-0.	-0.	-0.	-0.
245.00	3.0000	7.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
247.00	3.0000	-0.	5.5307	92.996	4.9720	4.0760	4.0300	65.820	2.9900	2.8600	-0.	-0.	-0.	-0.

42

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
ESTIMATE OF MEAN			6.5693	86.832	4.3359	3.8454	4.4640	52.459	3.9456	3.3417	0.	0.	0.	0.
ESTIMATE OF STANDARD DEVIATION			5.4114	40.036	1.5119	1.2769	4.3038	34.253	2.0264	1.3968	-0.	-0.	-0.	-0.
DEGREES OF FREEDOM			57	57	56	57	57	57	56	57	0	0	0	0
T VALUE			9.2452	16.517	21.654	22.934	7.8991	11.664	14.703	18.221	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES

CAR NO	TEST NO	CAR MAKE	HC 72HOT	CO 72HOT	NOX 72HOT	NOXP 72HOT	HC 75COLD	CO 75COLD	NOX 75COLD	NOXP 75CLD
151.00	3.0000	7.0000	2.3320	28.027	3.6733	3.3533	2.6720	36.714	3.7541	3.3293
153.00	3.0000	3.0000	7.7533	71.053	6.3027	4.8903	8.0796	80.514	5.7402	4.8454
154.00	3.0000	1.0000	3.9733	88.879	2.2923	2.1187	4.1652	91.091	2.6119	2.3572
155.00	3.0000	4.0000	4.1567	74.486	2.3587	2.2000	4.7205	83.310	2.3463	2.1811
156.00	3.0000	9.0000	3.5600	20.024	8.5853	7.0520	3.9183	28.531	8.3015	6.0576
157.00	3.0000	3.0000	3.0440	24.921	6.0413	5.0333	3.5159	38.390	5.5030	4.6905
159.00	3.0000	9.0000	2.9720	36.611	4.7453	4.3000	3.7391	43.425	4.4959	4.1893
160.00	3.0000	3.0000	5.8920	76.709	2.9613	2.5853	5.1581	93.344	2.8621	2.5991
161.00	3.0000	12.000	3.4480	47.583	4.6173	3.8653	3.8253	48.222	4.9080	4.1193
162.00	3.0000	3.0000	3.3787	27.387	6.0267	5.0840	4.0277	32.138	5.6660	4.8415
163.00	3.0000	9.0000	1.9613	45.017	1.6733	1.3467	2.5542	47.229	1.6556	1.3805
166.00	3.0000	2.0000	12.251	193.74	2.9947	2.9027	11.891	191.83	3.3398	3.2169
168.00	3.0000	7.0000	5.7280	110.63	2.9627	2.5680	6.4349	121.07	2.7821	2.4379
169.00	3.0000	5.0000	8.2093	39.447	5.4973	4.6920	8.6393	48.911	5.5019	4.7591
173.00	3.0000	2.0000	2.8927	52.560	5.0467	4.6787	3.1447	56.032	5.1665	4.8197
174.00	3.0000	12.000	14.897	100.67	1.7827	1.4053	14.596	101.31	1.7953	1.4598
175.00	3.0000	11.000	4.1507	81.797	2.9693	2.6120	5.9068	95.297	2.6815	2.4452
176.00	3.0000	8.0000	4.5680	64.468	8.3440	7.0813	5.9869	90.959	6.6389	5.6893
177.00	3.0000	3.0000	2.5427	58.232	4.1253	3.4120	3.7541	75.220	3.7939	3.2354
178.00	3.0000	1.0000	4.7533	66.520	3.1813	2.6960	4.8967	70.201	3.0380	2.6048
179.00	3.0000	8.0000	3.1853	8.1653	5.7693	4.4560	3.3717	12.732	6.4511	4.2318
181.00	3.0000	2.0000	6.3773	138.23	2.5653	2.2320	6.6399	140.20	2.6227	2.3639
182.00	3.0000	3.0000	4.6227	56.761	5.9253	4.9187	5.0865	67.787	5.7092	4.6893
183.00	3.0000	3.0000	4.2973	43.879	3.3760	3.4840	4.6396	49.451	3.2522	3.3974
185.00	3.0000	-0.	4.0440	71.117	6.8907	6.1147	4.3129	79.969	6.6923	5.9965
186.00	3.0000	3.0000	2.0920	29.833	4.9613	3.8773	3.1332	37.613	4.9539	3.9542
187.00	3.0000	9.0000	3.3947	22.059	6.5213	5.6227	3.8757	40.029	5.5002	4.9100
190.00	3.0000	9.0000	3.6920	53.955	5.3827	4.5653	4.0159	62.493	5.9444	4.2162
191.00	3.0000	7.0000	4.5333	49.823	4.8587	4.0880	7.6953	76.742	4.5955	3.8879
194.00	3.0000	12.000	11.152	94.189	2.1840	1.7173	11.358	82.902	2.3084	1.8612
196.00	3.0000	9.0000	4.1667	28.997	5.3453	4.4627	4.7515	43.613	4.9188	4.2322
197.00	3.0000	6.0000	11.780	199.29	1.7067	1.3880	13.786	216.10	1.5981	1.2212
200.00	3.0000	12.000	4.5507	41.637	2.6053	2.2627	4.7055	43.888	2.7756	2.3882
204.00	3.0000	1.0000	4.5227	85.729	8.6367	6.9760	5.1442	99.753	7.8842	6.8315
205.00	3.0000	9.0000	5.9813	86.508	7.1173	4.2493	6.6670	103.47	6.7825	4.0303
206.00	3.0000	9.0000	3.2280	47.763	5.4280	4.4773	3.8019	54.822	5.3209	4.4842
207.00	3.0000	4.0000	3.5547	68.500	3.9933	3.3680	4.7237	76.933	3.4326	2.9151
208.00	3.0000	9.0000	3.8200	26.357	4.6200	4.0920	3.8303	34.586	4.4388	3.9464
209.00	3.0000	4.0000	34.137	113.99	2.8773	2.4773	37.480	138.83	2.6767	2.3908
211.00	3.0000	7.0000	7.4907	116.32	4.9160	4.2120	7.8433	119.64	5.0886	4.3645
213.00	3.0000	4.0000	3.4013	34.623	5.9560	5.0213	4.1788	59.416	5.6166	4.8040
214.00	3.0000	3.0000	4.3707	62.735	-0.	5.0640	4.9635	93.092	-0.	5.7601
216.00	3.0000	9.0000	3.6013	21.737	7.8187	6.4213	3.9648	39.661	7.6828	6.3634
217.00	3.0000	3.0000	3.2080	16.065	6.7120	5.6653	3.4505	21.662	6.5939	5.5742
218.00	3.0000	5.0000	3.4387	51.424	5.7307	4.5453	3.7196	57.873	5.6470	4.5132
220.00	3.0000	5.0000	3.5147	45.063	6.0200	5.1427	4.0095	61.195	5.7964	4.9506
221.00	3.0000	9.0000	3.3827	44.929	4.5720	4.1480	3.7754	55.617	4.3616	4.4983
223.00	3.0000	5.0000	4.1580	65.831	5.0120	4.5387	4.7436	88.086	4.8234	4.3536
225.00	3.0000	5.0000	4.5893	85.812	5.4973	4.6560	4.9396	91.231	5.2244	4.5379
227.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
228.00	3.0000	7.0000	3.5373	61.047	6.3587	5.3827	3.9570	73.761	5.8507	5.0220
229.00	3.0000	9.0000	3.4707	49.804	6.6667	5.7747	3.9070	55.685	6.6821	5.8165
231.00	3.0000	6.0000	4.4653	93.647	4.0560	3.6773	4.9985	104.65	3.8215	3.5587
235.00	3.0000	1.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
236.00	3.0000	3.0000	3.8467	37.527	6.4120	5.4493	4.4125	46.318	6.1121	5.3209
238.00	3.0000	8.0000	4.6467	76.405	3.5680	3.1720	5.0566	84.920	3.5216	3.1026
239.00	3.0000	-0.	3.7067	43.327	4.6773	4.4000	4.0071	50.801	4.4985	4.4218
240.00	3.0000	12.000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
241.00	3.0000	9.0000	3.2600	71.608	3.6613	3.1760	3.7789	81.500	3.5352	3.1456
242.00	3.0000	9.0000	4.1933	64.627	2.9627	2.8240	4.8997	74.228	2.9564	2.8360
245.00	3.0000	7.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
247.00	3.0000	-0.	4.7373	67.115	4.8387	4.1827	5.0785	78.244	4.8960	4.1368

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES

CAR NO	TEST NO	CAR MAKE	HC 72HOT	CO 72HOT	NOX 72HOT	NOXP 72HOT	HC 75COLD	CO 75COLD	NOX 75COLD	NOXP 75CLD
ESTIMATE OF MEAN			5.2175	63.177	4.8007	4.0890	5.7987	73.349	4.6008	3.9842
ESTIMATE OF STANDARD DEVIATION			4.6018	37.399	1.7899	1.4400	4.9070	37.544	1.6352	1.3409
DEGREES OF FREEDOM			57	57	56	57	57	57	56	57
T VALUE			8.6346	12.865	20.249	21.625	8.9997	14.879	21.243	22.628

TABLE 1

SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC 01	CO 01	NOX 01	NOXP 01	HC 02	CO 02	NOX 02	NOXP 02	HC 03	CO 03	NOX 03	NOXP 03
151.00	1.1000	27640	93.786	.31177	3455.8	-0.	158.07	.51182	2649.6	-0.	239.33	2.0541	493.51	-0.
152.00	1.1000	69774	17.496	2.2639	279.98	-0.	30.063	.80991	568.89	-0.	53.998	.91329	54.820	-0.
153.00	1.1000	59406	135.31	.55245	2802.0	-0.	182.39	1.3225	1302.0	-0.	196.89	1.4851	120.61	-0.
154.00	1.1000	59597	133.24	2.4041	769.37	-0.	138.41	2.4126	298.30	-0.	94.691	3.0310	74.804	-0.
155.00	1.1000	76017	164.97	1.5736	1691.8	-0.	247.60.	2.0918	859.80	-0.	381.22	6.5988	68.018	-0.
156.00	1.1000	14416	252.90	.44877	4302.1	-0.	255.56	.25584	2884.1	-0.	286.25	3.6452	161.51	-0.
157.00	1.1000	27986	150.93	.12907	4394.3	-0.	180.63	.12287	3452.6	-0.	230.74	.82380	188.15	-0.
158.00	1.1000	26212	341.85	3.6048	2008.2	-0.	373.52	5.1672	419.74	-0.	794.41	4.6471	47.408	-0.
159.00	1.1000	12793	168.04	1.1193	2870.7	-0.	149.86	.44073	1907.1	-0.	147.27	5.6510	111.88	-0.
160.00	1.1000	62835	211.96	1.1505	2230.6	-0.	223.80	2.3085	824.95	-0.	299.67	5.4505	112.20	-0.
161.00	1.1000	4645.0	180.43	1.3541	2745.7	-0.	202.92	.54396	151.68	-0.	195.01	3.7792	91.717	-0.
162.00	1.1000	17446	171.06	.24342	3652.5	-0.	225.49	.26884	3469.0	-0.	239.88	3.3941	162.52	-0.
163.00	1.1000	77591	162.15	1.5892	1470.1	-0.	230.07	1.6534	926.27	-0.	179.01	2.0701	97.235	-0.
164.00	1.1000	63725	556.02	6.1329	1076.7	-0.	807.37	7.5564	246.81	-0.	5041.3	8.0985	65.453	-0.
165.00	1.1000	24665	193.91	.78094	2816.4	-0.	240.11	.27709	2677.1	-0.	313.03	6.9234	110.72	-0.
166.00	1.1000	82223	230.07	2.6708	1194.6	-0.	409.58	4.7976	420.96	-0.	449.88	6.2264	98.761	-0.
167.00	1.1000	52206	180.08	.59208	3882.7	-0.	274.11	.82085	2141.4	-0.	647.82	7.3071	77.505	-0.
168.00	1.1000	43086	243.89	2.3477	1952.4	-0.	290.35	3.2102	1618.7	-0.	261.08	3.8226	128.12	-0.
169.00	1.1000	13102	228.08	.20360	4241.4	-0.	275.94	.48402	1895.3	-0.	347.53	8.4393	122.77	-0.
170.00	1.1000	42559	141.41	.19802	2633.8	-0.	224.09	.38656	1853.6	-0.	198.96	1.9106	146.94	-0.
171.00	1.1000	65253	183.43	4.1823	435.77	-0.	186.03	3.4962	200.53	-0.	392.08	6.2590	87.047	-0.
172.00	1.1000	54667	144.27	.29202	2422.3	-0.	296.98	1.1863	2297.6	-0.	284.91	2.0970	206.67	-0.
173.00	1.1000	46469	120.18	1.7600	708.26	-0.	155.05	1.4129	478.72	-0.	182.35	3.3177	114.39	-0.
174.00	1.1000	36438	191.83	1.2084	2069.3	-0.	211.56	1.6776	895.09	-0.	238.03	4.1484	111.70	-0.
175.00	1.1000	54424	384.87	8.1154	275.77	-0.	201.64	.14893	1568.0	-0.	419.67	6.6545	148.92	-0.
176.00	1.1000	65164	158.69	.61031	3661.3	-0.	217.24	.77950	2799.5	-0.	163.98	.32148	256.10	-0.
177.00	1.1000	73204	179.39	3.0793	1630.3	-0.	174.09	2.0817	1017.1	-0.	221.97	2.4392	64.762	-0.
178.00	1.1000	10063	3591.3	.56830	2057.5	-0.	3627.9	1.4616	872.22	-0.	3068.2	2.9881	136.59	-0.
179.00	1.1000	34957	247.22	.43830	3525.6	-0.	289.47	.18744	3733.1	-0.	262.17	.53706	577.23	-0.
180.00	1.1000	63085	165.34	.40073	2413.7	-0.	231.76	1.2232	1336.4	-0.	133.15	2.5413	70.255	-0.
181.00	1.1000	87243	190.33	1.5705	2205.6	-0.	337.91	4.2552	674.36	-0.	282.20	5.4155	110.25	-0.
182.00	1.1000	21791	219.17	.38955	4230.9	-0.	327.73	1.6731	2426.7	-0.	334.77	5.7811	133.77	-0.
183.00	1.1000	45764	194.98	.38528	2880.4	-0.	317.88	1.7143	1724.4	-0.	292.76	4.4095	471.41	-0.
184.00	1.1000	80786	221.03	1.1108	2760.9	-0.	335.52	3.4409	1157.2	-0.	400.16	6.6423	124.87	-0.
185.00	1.1000	12158	145.63	.50350	3404.5	-0.	204.63	1.6911	1830.1	-0.	185.08	2.7716	135.69	-0.
186.00	1.1000	78988	68.629	.45328	2875.9	-0.	68.629	.95040	890.83	-0.	89.609	3.1195	63.488	-0.
187.00	1.1000	16610	134.98	.16661	3822.7	-0.	264.24	.21042	3458.7	-0.	445.58	4.5780	145.41	-0.
188.00	1.1000	49773	257.72	.22273	2815.0	-0.	292.33	.63574	1152.6	-0.	603.82	6.3274	83.331	-0.
189.00	1.1000	59909	217.79	.58153	3394.5	-0.	267.58	1.5853	2348.1	-0.	273.14	3.7347	144.59	-0.
190.00	1.1000	54599	135.17	1.8724	1535.7	-0.	172.96	1.4794	1294.9	-0.	377.85	7.4538	57.427	-0.
191.00	1.1000	51624	218.30	1.9744	2930.3	-0.	271.73	3.0568	2174.4	-0.	306.29	6.4800	121.95	-0.
192.00	1.1000	37268	218.62	.41586	4351.7	-0.	272.12	.82861	2976.5	-0.	184.36	.32570	269.93	-0.
193.00	1.1000	58557	282.20	.92633	2647.3	-0.	328.11	1.5107	1171.0	-0.	353.34	5.6447	83.686	-0.
194.00	1.1000	57139	257.72	3.1845	1920.8	-0.	355.27	1.9013	868.43	-0.	409.08	5.8280	55.359	-0.
195.00	1.1000	48576	85.573	.15622	1452.9	-0.	164.60	.20691	1794.3	-0.	659.52	2.5349	135.30	-0.
196.00	1.1000	22790	205.00	1.8826	2447.1	-0.	232.28	.91466	2414.8	-0.	148.21	1.4835	258.10	-0.
197.00	1.1000	81907	631.26	.74358	5329.2	-0.	712.17	3.0239	1685.2	-0.	614.64	2.1143	187.97	-0.
198.00	1.1000	43317	231.23	1.8483	2087.4	-0.	285.26	3.2329	457.97	-0.	264.41	2.8688	82.515	-0.
199.00	1.1000	36615	189.28	.41403	3633.2	-0.	329.25	5.4580	460.73	-0.	802.31	6.6874	91.413	-0.
200.00	1.1000	55488	-0.	1.8977	1906.2	-0.	-0.	2.8148	492.27	-0.	-0.	8.7865	100.70	-0.
201.00	1.1000	55846	60.573	.22757	2216.3	-0.	135.37	.19641	1687.6	-0.	95.154	1.1216	77.809	-0.
202.00	1.1000	61236	86.067	.19937	1899.9	-0.	235.36	.13650	2812.2	-0.	311.81	1.7737	232.22	-0.
203.00	1.1000	54778	181.01	.40921	2270.1	-0.	632.78	.39629	1980.5	-0.	208.63	2.5243	111.20	-0.
204.00	1.1000	43855	174.57	1.0465	2897.4	-0.	237.43	1.0701	1624.6	-0.	161.02	3.3765	101.27	-0.
205.00	1.1000	35414	146.94	1.9557	1462.9	-0.	125.66	.77495	582.59	-0.	187.08	1.7226	43.770	-0.
206.00	1.1000	23904	108.21	1.7369	1296.5	-0.	128.27	1.3545	835.89	-0.	121.58	2.5568	66.845	-0.
207.00	1.1000	47782	171.29	1.5719	2486.4	-0.	236.63	1.9823	1547.2	-0.	413.98	4.5342	103.28	-0.
208.00	1.1000	53563	183.82	.51983	2801.6	-0.	209.69	.70362	1590.7	-0.	241.20	7.4901	88.724	-0.
209.00	1.1000	57648	206.66	.32853	2040.9	-0.	314.15	.20910	1519.9	-0.	754.96	2.0113	71.875	-0.
210.00	1.1000	59399	271.33	2.5131	2203.7	-0.	307.23	.91132	2150.8	-0.	557.62	5.5373	451.12	-0.
211.00	1.1000	61258	222.00	3.8820	1624.4	-0.	267.39	3.2913	1202.4	-0.	259.16	5.3596	102.84	-0.
212.00	1.1000	58236	175.69	1.3881	2890.4	-0.	177.03	1.0024	1721.2	-0.	240.72	6.0603	125.75	-0.
213.00	1.1000	35385	60.203	.14804	2227.5	-0.	106.53	.42724	1026.7	-0.	193.77	2.5575	49.496	-0.
214.00	1.1000	26114	229.82	1.0328	3720.7	-0.	302.51	2.6786	1849.5	-0.	397.43	9.2551	74.782	-0.
215.00	1.1000	60827	206.74	2.0596	2217.4	-0.	276.32	2.0516	1883.8	-0.	231.18	4.1281	129.99	-0.
216.00	1.1000	39573	168.86	1.1884	2360.4	-0.	158.21	.70658	1322.7	-0.	183.54	.96416	320.21	-0.

46

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
217.00	1.1000	19097	225.68	.14637	3960.0	-0.	293.17	.14021	3305.4	-0.	377.13	6.7065	104.02	-0.
218.00	1.1000	53782	137.57	1.4339	1719.3	-0.	150.88	.64290	1382.3	-0.	124.29	2.0810	109.28	-0.
219.00	1.1000	51291	166.63	2.2967	791.96	-0.	159.63	1.9144	495.77	-0.	152.64	2.2054	45.902	-0.
220.00	1.1000	12724	185.90	.29767	4126.9	-0.	254.59	.48339	2992.9	-0.	203.66	5.3157	130.85	-0.
221.00	1.1000	46554	81.092	.79164	1500.1	-0.	151.53	1.1572	925.28	-0.	132.82	.56617	98.297	-0.
222.00	1.1000	12723	264.45	.87542	2377.6	-0.	329.03	.91649	794.47	-0.	284.01	1.9601	87.611	-0.
223.00	1.1000	34688	139.24	.24123	3063.3	-0.	208.41	.31069	2426.7	-0.	197.70	2.6072	145.21	-0.
224.00	1.1000	68569	169.97	.37152	2606.1	-0.	241.39	.57091	1502.3	-0.	177.87	2.6782	60.444	-0.
225.00	1.1000	49476	143.91	.22693	2743.5	-0.	145.25	.18347	827.80	-0.	130.53	1.6107	55.126	-0.
226.00	1.1000	58888	168.37	.33836	2616.4	-0.	158.87	.21970	658.61	-0.	133.16	1.4587	91.656	-0.
227.00	1.1000	47521	245.83	.16435	3176.0	-0.	354.80	.89398	1371.4	-0.	1094.6	2.7970	64.028	-0.
228.00	1.1000	31541	141.43	.92102	4223.2	-0.	200.84	1.3322	2362.7	-0.	341.47	6.3698	103.43	-0.
229.00	1.1000	12811	218.63	1.5862	2700.8	-0.	184.85	.38882	2262.4	-0.	168.72	4.5202	77.480	-0.
230.00	1.1000	21185	170.24	1.1153	2111.7	-0.	258.11	.24166	2060.6	-0.	482.75	6.9792	119.54	-0.
231.00	1.1000	25484	147.01	1.1365	2473.8	-0.	147.01	.34740	1677.5	-0.	136.27	3.4645	57.109	-0.
232.00	1.1000	25137	178.05	.37877	3677.0	-0.	253.11	.59191	2581.8	-0.	160.48	1.0441	164.40	-0.
233.00	1.1000	54584	209.15	.27821	3973.6	-0.	243.10	.30977	2331.0	-0.	375.78	4.7689	111.19	-0.
234.00	1.1000	42787	245.89	3.8980	1102.8	-0.	238.89	3.8471	90.908	-0.	862.28	5.1412	48.189	-0.
235.00	1.1000	20301	126.42	.14590	3066.3	-0.	179.26	.14590	2281.4	-0.	267.21	6.1570	154.13	-0.
236.00	1.1000	14976	247.42	1.7935	2621.0	-0.	252.90	.13379	2672.6	-0.	344.34	5.3740	119.77	-0.
237.00	1.1000	19286	225.72	1.7651	1849.9	-0.	228.49	1.1330	948.57	-0.	166.62	1.3910	51.522	-0.
238.00	1.1000	42111	265.50	3.4826	1760.[illegible]	-0.	317.85	3.3102	1502.8	-0.	291.60	4.7375	136.56	-0.
239.00	1.1000	36397	177.56	1.0953	2453.8	-0.	185.78	.49511	1553.3	-0.	121.73	.65041	141.04	-0.
240.00	1.1000	46474	303.01	3.4095	1540.5	-0.	465.31	6.4899	301.86	-0.	625.61	9.6649	92.526	-0.
241.00	1.1000	37325	254.00	.69717	3028.5	-0.	269.19	.33716	1868.7	-0.	298.32	2.9380	160.63	-0.
242.00	1.1000	52910	184.14	.57650	2878.5	-0.	203.35	1.6186	719.25	-0.	131.03	.72800	42.374	-0.
243.00	1.1000	73943	142.59	.28483	2510.2	-0.	173.54	.41858	1456.6	-0.	153.82	.75374	79.842	-0.
244.00	1.1000	65233	204.77	.86842	2718.4	-0.	296.18	1.4569	1696.8	-0.	227.60	4.2877	44.068	-0.
245.00	1.1000	29460	122.32	1.1331	2029.4	-0.	249.12	1.8937	834.20	-0.	331.67	8.0492	79.295	-0.
246.00	1.1000	39845	171.85	.46875	2882.3	-0.	251.45	1.3964	1172.2	-0.	796.01	.13442	64.509	-0.
247.00	1.1000	48794	211.79	.16493	3534.1	-0.	273.99	.74314	2084.8	-0.	223.04	1.1486	283.08	-0.
248.00	1.1000	56334	183.97	.41238	2998.8	-0.	294.51	1.6487	1685.5	-0.	298.87	4.1657	117.34	-0.
249.00	1.1000	1.02571E+05	271.76	1.9044	2080.6	-0.	325.04	2.0071	1159.8	-0.	280.36	2.1275	87.949	-0.
250.00	1.1000	24272	238.19	.47464	2840.8	-0.	384.76	1.4019	2004.4	-0.	1102.8	10.332	70.383	-0.
251.00	1.1000	20003	238.21	.46883	4595.6	-0.	298.15	.28397	3547.1	-0.	404.08	4.3523	134.47	-0.
252.00	1.1000	14945	151.12	1.7943	2936.8	-0.	171.71	1.3986	1044.0	-0.	193.77	2.1078	89.508	-0.
253.00	1.1000	64943	176.27	.15333	3386.1	-0.	228.00	.60714	1948.7	-0.	520.32	3.2737	67.933	-0.
254.00	1.1000	22610	158.47	.18373	3894.8	-0.	258.88	.91347	2818.0	-0.	158.47	1.0588	271.80	-0.
255.00	1.1000	66173	174.36	2.3695	961.36	-0.	178.52	.50486	1125.6	-0.	178.52	2.8843	70.716	-0.
256.00	1.1000	11099	145.35	.59107	2704.6	-0.	152.38	.46769	1408.6	-0.	191.92	2.7100	87.737	-0.
257.00	1.1000	26789	130.99	.20883	2818.4	-0.	137.84	.17774	934.65	-0.	58.993	.34084	117.76	-0.
258.00	1.1000	26521	227.32	1.6957	2405.6	-0.	309.26	2.9404	1164.1	-0.	211.93	1.3237	254.15	-0.
259.00	1.1000	81903	613.60	1.8971	2359.4	-0.	1407.7	7.4817	328.51	-0.	2037.9	13.198	86.281	-0.
260.00	1.1000	23524	100.69	.86494	3834.0	-0.	168.96	1.9468	2460.4	-0.	249.35	6.1661	113.80	-0.
261.00	1.1000	22861	142.37	.35440	4379.8	-0.	174.11	.31627	2282.6	-0.	250.83	4.3115	130.74	-0.
262.00	1.1000	17020	413.93	8.6668	304.40	-0.	409.59	5.5078	570.09	-0.	485.42	6.5487	85.170	-0.
263.00	1.1000	25176	189.92	.64471	3324.8	-0.	302.00	1.9991	1428.2	-0.	435.79	9.5982	67.772	-0.
264.00	1.1000	37737	147.23	.20890	3105.2	-0.	325.87	2.0402	1925.9	-0.	423.45	8.9466	83.162	-0.
265.00	1.1000	51796	208.19	.72348	3392.9	-0.	201.16	.67032	1280.5	-0.	152.19	.87172	152.34	-0.
266.00	1.1000	56340	105.39	.45013	1400.7	-0.	112.31	.43107	534.04	-0.	106.77	.60436	27.276	-0.
267.00	1.1000	40072	159.90	.45483	2062.8	-0.	187.96	.14230	1324.3	-0.	227.45	3.8640	175.70	-0.
268.00	1.1000	51561	179.85	1.8776	1721.9	-0.	226.19	.88228	1978.1	-0.	285.81	6.0100	119.49	-0.
269.00	1.1000	42523	214.28	.57566	2505.1	-0.	245.26	.47760	1306.6	-0.	349.44	7.5729	61.922	-0.
270.00	1.1000	27635	243.76	2.0166	2427.4	-0.	331.84	1.1549	2569.6	-0.	229.69	5.0625	161.64	-0.
271.00	1.1000	17345	119.66	.22970	2791.3	-0.	196.70	1.1193	1908.5	-0.	206.58	2.7045	107.47	-0.
272.00	1.1000	40191	185.04	.33049	3594.5	-0.	280.74	.41384	2716.0	-0.	341.07	5.6326	209.12	-0.
273.00	1.1000	15714	186.81	1.4833	2679.7	-0.	208.13	1.6042	1692.5	-0.	248.16	7.7593	93.446	-0.
274.00	1.1000	76117	1373.7	.63216	2669.4	-0.	1523.0	1.0546	2005.9	-0.	1634.1	5.0492	88.083	-0.
275.00	1.1000	14183	273.84	.74933	3430.8	-0.	283.89	.88770	1556.3	-0.	253.81	1.4158	182.08	-0.
276.00	1.1000	33664	156.20	1.7581	2884.7	-0.	179.68	1.5966	1216.2	-0.	181.06	3.4340	114.38	-0.
277.00	1.1000	76193	219.21	.13668	4190.0	-0.	266.45	.11164	2805.0	-0.	246.36	.40477	239.81	-0.
278.00	1.1000	55179	291.76	1.5242	2672.9	-0.	436.48	3.2326	1542.2	-0.	753.71	6.9350	80.716	-0.
279.00	1.1000	52128	141.18	.22098	3148.6	-0.	120.19	.17130	1186.7	-0.	257.44	4.1910	133.56	-0.
280.00	1.1000	30897	172.90	2.2840	1753.7	-0.	189.93	.78104	2111.5	-0.	313.60	.51368	83.596	-0.
281.00	1.1000	55605	100.66	1.2887	1124.5	-0.	165.08	.97093	860.87	-0.	149.60	2.2090	152.79	-0.
282.00	1.1000	63299	191.08	.98387	2489.0	-0.	300.26	2.0290	1111.4	-0.	329.75	6.3623	133.55	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
283.00	1.1000	61965	145.28	.88842	2756.8	-0.	196.50	.71942	1982.2	-0.	170.83	1.9523	154.51	-0.
284.00	1.1000	28963	170.77	.50384	3743.5	-0.	183.54	.42606	2596.4	-0.	330.36	6.4977	98.322	-0.
285.00	1.1000	21528	113.71	.16511	2724.7	-0.	189.93	.16511	3132.4	-0.	218.44	2.8626	120.35	-0.
286.00	1.1000	49323	184.29	3.5820	735.19	-0.	213.98	2.4596	624.33	-0.	122.62	2.9498	52.069	-0.
287.00	1.1000	25220	150.12	1.8641	1703.0	-0.	186.56	1.7870	1012.6	-0.	231.74	9.1668	98.669	-0.
288.00	1.1000	44070	206.40	.32689	3022.9	-0.	256.39	.45406	2069.6	-0.	195.04	.78184	111.46	-0.
289.00	1.1000	-0.	106.84	.65172	2252.5	-0.	134.58	.35715	1246.3	-0.	264.06	2.7157	61.627	-0.
290.00	1.1000	69383	138.21	.23026	3532.0	-0.	185.08	.37063	2297.2	-0.	155.20	2.0949	141.29	-0.
291.00	1.1000	18753	222.82	1.1315	3660.9	-0.	294.39	.67012	3062.1	-0.	365.47	8.1516	91.192	-0.
292.00	1.1000	55768	142.24	1.6092	2018.7	-0.	125.31	1.8479	355.96	-0.	132.36	3.1905	55.837	-0.
293.00	1.1000	47310	182.28	1.0456	3517.0	-0.	279.40	1.8028	2077.5	-0.	273.64	4.2617	123.26	-0.
294.00	1.1000	56745	122.2	.64302	3434.3	-0.	185.15	2.2550	2108.3	-0.	295.94	7.2676	117.13	-0.
295.00	1.1000	37652	162.06	1.3639	2801.6	-0.	262.27	2.5846	1628.8	-0.	305.80	5.4637	83.209	-0.
296.00	1.1000	23661	245.94	1.2002	2909.6	-0.	241.68	.68473	1883.5	-0.	298.81	4.6720	134.25	-0.
297.00	1.1000	29228	149.38	.38217	4174.5	-0.	201.53	.31816	3637.2	-0.	217.13	2.0302	151.28	-0.
298.00	1.1000	55822	170.83	1.4195	2501.1	-0.	219.43	1.1942	1840.7	-0.	199.36	2.6605	120.94	-0.
299.00	1.1000	90752	146.70	1.5062	1453.6	-0.	203.66	1.7093	490.60	-0.	370.86	3.5020	92.794	-0.
300.00	1.1000	23585	170.83	.86527	2120.7	-0.	277.17	3.1279	1098.9	-0.	328.20	8.8586	96.609	-0.
ESTIMATE OF MEAN			222.50	1.2243	2612.7	0.	283.94	1.4414	1620.1	0.	376.28	4.0864	124.15	0.
ESTIMATE OF STANDARD DEVIATION			305.59	1.3047	975.90	-0.	325.35	1.4166	845.38	-0.	545.76	2.5866	82.095	-0.
DEGREES OF FREEDOM			148	149	149	0	148	149	149	0	148	149	149	0
T VALUE			8.8875	11.493	32.789	-0.	10.653	12.462	23.471	-0.	8.4159	19.349	18.521	-0.

48

TABLE 1

SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
151.00	1.1000	27640	93.786	.31177	3455.8	-0.	158.07	.51182	2649.6	-0.	239.33	2.0541	493.51	-0.
151.00	1.2000	27640	93.149	.64607	3007.9	-0.	162.61	.59280	2530.6	-0.	186.05	1.7923	269.65	-0.
152.00	1.1000	69774	17.496	2.2639	279.98	-0.	30.043	.80991	568.89	-0.	53.998	.91329	54.820	-0.
152.00	1.2000	69774	-0.	4.6016	393.51	-0.	192.04	1.0852	1768.3	-0.	87.807	.88263	50.291	-0.
153.00	1.1000	59406	135.31	.55245	2802.0	-0.	182.39	1.3225	1302.0	-0.	196.89	1.4851	120.61	-0.
153.00	1.2000	59406	180.59	.37100	2446.4	-0.	243.20	1.5188	1097.9	-0.	234.00	3.6552	47.073	-0.
154.00	1.1000	59597	133.24	2.4041	769.37	-0.	138.41	2.4126	298.30	-0.	94.691	3.0310	74.804	-0.
154.00	1.2000	59597	180.22	2.6383	1117.3	-0.	218.14	3.0064	417.27	-0.	153.37	3.6914	90.943	-0.
155.00	1.1000	76017	164.97	1.5736	1691.8	-0.	247.60	2.0918	859.80	-0.	381.22	6.5988	68.018	-0.
155.00	1.2000	76017	189.92	1.4643	2811.2	-0.	251.46	2.3713	1492.9	-0.	225.15	4.1818	108.87	-0.
156.00	1.1000	14416	252.90	.44877	4302.1	-0.	255.56	.25584	2884.1	-0.	286.25	3.6452	161.51	-0.
156.00	1.2000	14416	224.77	.29870	5101.1	-0.	238.03	.15408	3064.2	-0.	232.72	2.1321	200.82	-0.
157.00	1.1000	27986	150.93	.12907	4394.3	-0.	186.63	.12287	3452.6	-0.	230.74	.82380	188.15	-0.
157.00	1.2000	27986	161.08	.25237	4007.2	-0.	193.62	.14669	3253.6	-0.	130.11	.53307	212.95	-0.
158.00	1.1000	26212	341.85	3.6048	2008.2	-0.	373.52	5.1672	419.74	-0.	794.41	4.6471	47.408	-0.
158.00	1.2000	26212	163.77	.50644	3878.4	-0.	385.9	6.0494	483.87	-0.	572.24	6.4310	38.923	-0.
159.00	1.1000	12793	168.04	1.1193	2870.7	-0.	149.86	.44073	1907.1	-0.	147.27	5.6510	111.88	-0.
159.00	1.2000	12793	149.65	.88051	2577.9	-0.	139.31	.18549	1896.8	-0.	148.35	2.5530	209.36	-0.
160.00	1.1000	62835	211.96	1.1505	2230.6	-0.	223.80	2.3085	824.95	-0.	299.67	5.4505	112.20	-0.
160.00	1.2000	62835	223.09	.83060	2853.0	-0.	330.89	1.9373	1597.0	-0.	235.06	1.1863	135.90	-0.
161.00	1.1000	4645.0	188.43	1.3541	2745.7	-0.	202.92	.54395	151.68	-0.	195.01	3.7792	91.717	-0.
161.00	1.2000	4645.0	133.59	1.0755	3919.9	-0.	187.86	.67045	2329.1	-0.	269.43	6.2372	80.885	-0.
162.00	1.1000	17446	171.06	.24342	3652.5	-0.	225.49	.26884	3469.0	-0.	239.88	3.3941	162.52	-0.
162.00	1.2000	17446	183.18	.29268	3654.7	-0.	264.87	.84523	2685.9	-0.	243.62	2.6134	172.42	-0.
163.00	1.1000	77591	162.15	1.5892	1478.1	-0.	230.07	1.4534	926.27	-0.	179.01	2.0701	97.235	-0.
163.00	1.2000	77591	250.84	2.1213	1592.2	-0.	303.62	2.3767	1059.4	-0.	269.70	2.8436	104.82	-0.
164.00	1.1000	63725	556.02	6.1329	1076.7	-0.	807.37	7.5564	246.81	-0.	5041.3	8.0985	65.453	-0.
164.00	1.2000	63725	267.18	5.2115	1203.1	-0.	508.65	7.4104	249.18	-0.	2101.5	9.9632	73.032	-0.
165.00	1.1000	24665	193.91	.78094	2816.4	-0.	240.11	.27709	2677.1	-0.	313.03	6.9234	110.72	-0.
165.00	1.2000	24665	144.27	.37528	3331.9	-0.	246.27	.93458	2370.0	-0.	313.14	9.0881	89.771	-0.
166.00	1.1000	82223	230.07	2.1704	1194.6	-0.	409.58	4.7976	420.96	-0.	449.88	6.2264	98.761	-0.
166.00	1.2000	82223	214.90	2.1757	2385.2	-0.	410.78	4.6439	904.82	-0.	452.62	7.3775	100.91	-0.
167.00	1.1000	52206	180.08	.9208	3882.7	-0.	274.11	.82085	2141.4	-0.	647.82	7.3071	77.505	-0.
167.00	1.2000	52206	158.32	.45214	3506.9	-0.	218.79	.51063	1912.9	-0.	445.45	5.4182	74.594	-0.
168.00	1.1000	43086	243.89	2.3477	1952.4	-0.	293.35	3.2102	1616.7	-0.	261.08	3.8226	128.12	-0.
168.00	1.2000	43086	256.45	3.6288	1558.8	-0.	315.89	3.5400	1314.0	-0.	286.05	7.0429	88.028	-0.
169.00	1.1000	13102	228.08	.20360	4241.4	-0.	275.94	.48402	1895.3	-0.	347.53	8.4393	122.77	-0.
169.00	1.2000	13102	204.97	.19175	4517.8	-0.	262.01	.25732	2828.2	-0.	157.87	.80530	104.21	-0.
170.00	1.1000	42559	141.41	.19802	2633.8	-0.	224.09	.38856	1853.6	-0.	198.96	1.9106	146.94	-0.
170.00	1.2000	42559	119.74	.16013	2667.1	-0.	195.57	.19757	2055.1	-0.	161.39	.70230	128.48	-0.
171.00	1.1000	65253	183.43	4.1923	435.77	-0.	186.03	3.4962	200.53	-0.	392.68	6.2590	87.047	-0.
171.00	1.2000	65253	296.91	4.4028	995.03	-0.	318.75	3.4405	330.11	-0.	325.59	4.5140	49.635	-0.
172.00	1.1000	54667	144.27	.29202	2422.3	-0.	296.98	1.1863	2297.6	-0.	284.91	2.0970	206.67	-0.
172.00	1.2000	54667	114.72	.14802	2551.7	-0.	258.22	2.1593	1974.7	-0.	280.89	3.9177	193.47	-0.
173.00	1.1000	46469	120.18	1.7600	708.26	-0.	155.05	1.4129	478.72	-0.	182.39	3.3177	114.39	-0.
173.00	1.2000	46469	182.00	2.2903	1154.5	-0.	198.05	2.0351	897.96	-0.	164.68	1.7264	92.192	-0.
174.00	1.1000	36438	191.83	1.2684	2069.3	-0.	211.56	1.6776	895.09	-0.	238.03	4.1484	111.70	-0.
174.00	1.2000	36438	160.92	1.2340	2718.9	-0.	218.49	2.1471	788.77	-0.	271.31	4.7796	76.939	-0.
175.00	1.1000	54424	384.87	8.1104	275.77	-0.	261.64	.14893	1568.0	-0.	419.67	6.6545	148.92	-0.
175.00	1.2000	54424	280.00	10.633	124.87	-0.	246.99	.27405	2016.0	-0.	252.48	3.6811	139.09	-0.
176.00	1.1000	65164	158.69	.61031	3661.3	-0.	217.24	.77950	2799.5	-0.	163.98	.32148	258.10	-0.
176.00	1.2000	65164	139.55	.76871	3543.5	-0.	236.72	.66879	2345.3	-0.	201.40	2.3878	128.61	-0.
177.00	1.1000	79204	179.39	3.0793	1638.3	-0.	174.09	2.6817	1017.1	-0.	221.97	2.4392	64.762	-0.
177.00	1.2000	79204	191.14	3.5135	1772.7	-0.	277.24	3.8842	1343.1	-0.	459.99	6.3252	112.78	-0.
178.00	1.1000	10063	3591.3	.56830	2057.5	-0.	3627.9	1.4616	872.22	-0.	3868.2	2.9881	138.59	-0.
178.00	1.2000	10063	148.85	1.4994	1627.1	-0.	204.53	1.8108	1077.8	-0.	230.55	4.1893	151.08	-0.
179.00	1.1000	34957	247.22	.43830	3525.6	-0.	289.47	.18744	3733.1	-0.	262.17	.53706	577.23	-0.
179.00	1.2000	34957	185.72	.68705	2799.2	-0.	242.89	.27498	2867.2	-0.	158.74	.11128	84.769	-0.
180.00	1.1000	63085	165.34	.40073	2413.7	-0.	231.76	1.2232	1336.4	-0.	133.15	2.5413	70.255	-0.
180.00	1.2000	63085	140.88	.24928	2442.8	-0.	205.46	.82861	1528.2	-0.	144.89	1.8221	89.396	-0.
181.00	1.1000	87243	190.33	1.5705	2205.6	-0.	337.91	4.2552	674.36	-0.	282.20	5.4155	110.25	-0.
181.00	1.2000	87243	134.61	.94254	1873.1	-0.	188.99	3.5672	436.59	-0.	344.65	2.8204	103.72	-0.
182.00	1.1000	21791	219.17	.38955	4238.9	-0.	327.73	1.6731	2426.7	-0.	334.77	5.7811	133.77	-0.
182.00	1.2000	21791	204.11	.25505	4173.6	-0.	308.16	1.5573	2414.8	-0.	242.18	2.3750	198.68	-0.
183.00	1.1000	45764	194.95	.38528	2880.4	-0.	317.88	1.7143	1724.4	-0.	292.76	4.4095	471.41	-0.
183.00	1.2000	45764	196.77	.29212	2641.2	-0.	319.70	1.2218	2001.4	-0.	287.98	2.3408	146.45	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
184.00	1.1000	80785	221.03	1.1168	2760.9	-0.	335.52	3.4409	1157.2	-0.	400.18	6.6423	124.87	-0.
184.00	1.2000	80786	183.79	.84522	2606.1	-0.	273.54	3.0326	1138.7	-0.	238.82	2.7901	116.53	-0.
185.00	1.1000	12158	145.63	.50350	3404.5	-0.	204.83	1.6911	1838.1	-0.	185.08	2.7716	135.69	-0.
185.00	1.2000	12158	157.66	.56038	3937.8	-0.	212.79	1.6619	2103.5	-0.	201.71	3.6171	127.02	-0.
186.00	1.1000	78988	68.629	.45328	2875.9	-0.	68.629	.95640	890.63	-0.	84.609	3.1195	63.488	-0.
186.00	1.2000	78988	103.17	.59923	3124.0	-0.	103.17	1.1296	958.58	-0.	84.487	.63213	33.509	-0.
187.00	1.1000	16610	134.98	.16661	3822.7	-0.	264.24	.21042	3458.7	-0.	445.58	4.5780	145.41	-0.
187.00	1.2000	16610	145.94	.14280	5319.2	-0.	231.59	.13654	4810.0	-0.	386.35	4.5929	208.72	-0.
188.00	1.1000	49773	257.72	.22273	2815.0	-0.	292.33	.63574	1152.6	-0.	603.82	6.3274	83.331	-0.
188.00	1.2000	49773	101.52	.18785	1439.0	-0.	132.68	.30931	687.64	-0.	151.74	2.6308	68.980	-0.
189.00	1.1000	59909	217.79	.59153	3394.5	-0.	267.58	1.5853	2348.1	-0.	273.14	3.7347	144.59	-0.
189.00	1.2000	59909	186.26	1.2090	3156.6	-0.	247.72	.78858	2673.2	-0.	286.36	4.9724	113.93	-0.
190.00	1.1000	54599	135.17	1.8724	1535.7	-0.	172.96	1.4794	1294.9	-0.	377.85	7.4538	57.427	-0.
190.00	1.2000	54599	171.97	2.1573	1537.6	-0.	200.34	1.3699	1580.1	-0.	220.71	1.3407	139.48	-0.
191.00	1.1000	51624	218.30	1.9744	2930.3	-0.	271.73	3.6568	2174.4	-0.	306.29	6.4800	121.95	-0.
191.00	1.2000	51624	188.71	2.2144	2570.6	-0.	247.79	1.8709	2358.5	-0.	412.34	7.9304	81.785	-0.
192.00	1.1000	37268	218.52	.41586	4351.7	-0.	272.12	.82861	2976.5	-0.	164.36	.32570	289.93	-0.
192.00	1.2000	37268	207.43	.46741	4048.5	-0.	140.80	.42193	1309.5	-0.	156.71	.54602	348.08	-0.
193.00	1.1000	58557	282.20	.92633	2547.3	-0.	328.11	1.5107	1171.0	-0.	353.34	5.6447	83.686	-0.
193.00	1.2000	58557	410.70	1.3319	2722.9	-0.	457.81	1.7053	1276.3	-0.	460.68	4.7259	156.91	-0.
194.00	1.1000	57139	257.72	3.1845	1920.8	-0.	355.27	1.9013	868.83	-0.	409.08	5.8280	55.359	-0.
194.00	1.2000	57139	202.14	2.8475	2043.8	-0.	220.71	1.3409	1088.3	-0.	739.72	3.3358	43.892	-0.
195.00	1.1000	48576	85.573	.15622	1452.9	-0.	164.60	.20691	1794.3	-0.	659.52	2.5349	135.30	-0.
195.00	1.2000	48576	111.36	.17994	2742.0	-0.	207.56	.23666	2792.9	-0.	323.95	.43540	377.11	-0.
196.00	1.1000	22790	205.00	1.8622	2447.1	-0.	232.28	.91456	2414.8	-0.	148.21	1.4835	258.10	-0.
196.00	1.2000	22790	219.98	1.6546	2588.8	-0.	233.65	.63172	2609.3	-0.	142.83	.34439	275.36	-0.
197.00	1.1000	81907	631.26	.74358	5329.2	-0.	712.17	3.0239	1685.2	-0.	614.64	2.1143	187.97	-0.
197.00	1.2000	81907	278.07	2.1401	2416.8	-0.	371.98	1.6210	2163.4	-0.	306.90	4.1539	115.33	-0.
198.00	1.1000	43317	231.23	1.8483	2087.4	-0.	285.26	3.2329	457.97	-0.	264.41	2.8688	82.515	-0.
198.00	1.2000	43317	182.72	1.6727	2318.8	-0.	207.26	1.4847	992.23	-0.	233.30	3.7659	83.568	-0.
199.00	1.1000	36615	199.28	.41403	3833.2	-0.	329.25	5.4580	460.73	-0.	802.31	6.6874	91.413	-0.
199.00	1.2000	36615	27.557	.14801	879.16	-0.	100.50	2.6171	294.77	-0.	361.44	5.4744	39.469	-0.
200.00	1.1000	55488	-0.	1.8977	1905.2	-0.	-0.	2.8148	492.27	-0.	-0.	8.7865	100.70	-0.
200.00	1.2000	55488	145.10	1.6375	2265.0	-0.	192.21	2.0220	647.05	-0.	280.97	3.7928	60.107	-0.
201.00	1.1000	55846	60.573	.22757	2216.3	-0.	135.37	.19641	1687.8	-0.	95.154	1.1216	77.809	-0.
201.00	1.2000	55846	69.459	.14566	3176.7	-0.	102.58	.10289	1242.5	-0.	94.609	.35067	74.993	-0.
202.00	1.1000	61236	86.067	.19937	1899.9	-0.	235.36	.13650	2812.2	-0.	311.81	1.7737	232.22	-0.
202.00	1.2000	61236	62.165	.18784	2326.7	-0.	114.37	.12471	1444.0	-0.	199.94	1.0608	134.52	-0.
203.00	1.1000	54778	181.01	.40921	2270.1	-0.	632.78	.39629	1980.5	-0.	208.63	2.5243	111.20	-0.
203.00	1.2000	54778	148.80	1.9418	1996.2	-0.	491.76	1.1869	1512.6	-0.	189.82	.76109	214.97	-0.
204.00	1.1000	43855	174.57	1.0485	2897.4	-0.	237.43	1.8701	1624.8	-0.	161.02	3.3765	101.27	-0.
204.00	1.2000	43855	191.69	1.2560	3278.2	-0.	254.59	2.0323	1727.3	-0.	199.85	4.5961	87.765	-0.
205.00	1.1000	35414	146.94	1.9557	1462.9	-0.	125.66	.77495	582.59	-0.	187.08	1.7226	43.770	-0.
205.00	1.2000	35414	170.01	2.2319	1798.0	-0.	209.38	1.6352	1440.5	-0.	364.60	1.5378	78.587	-0.
206.00	1.1000	23904	108.21	1.7369	1296.5	-0.	128.27	1.3545	835.89	-0.	121.58	2.5568	66.845	-0.
206.00	1.2000	23904	119.89	1.8352	1358.3	-0.	146.65	7.2815	946.38	-0.	122.56	7.1227	85.547	-0.
207.00	1.1000	47782	171.29	1.5719	2486.4	-0.	236.63	1.9823	1547.2	-0.	413.98	4.5342	103.28	-0.
207.00	1.2000	47782	164.46	.88293	3021.2	-0.	255.01	1.6904	1704.1	-0.	584.06	6.2178	78.625	-0.
208.00	1.1000	53563	183.82	.51983	2801.6	-0.	209.69	.70362	1590.7	-0.	241.20	7.4901	88.724	-0.
208.00	1.2000	53563	187.90	.35820	2877.4	-0.	186.53	.25143	1650.9	-0.	196.12	4.4170	109.03	-0.
209.00	1.1000	57648	206.66	.32853	2040.9	-0.	314.15	.20910	1519.9	-0.	754.90	2.0113	71.875	-0.
209.00	1.2000	57648	207.17	.63253	2132.0	-0.	324.73	1.0114	1016.7	-0.	944.56	2.8228	55.126	-0.
210.00	1.1000	59399	271.33	2.5131	2203.7	-0.	307.23	.91132	2150.8	-0.	557.62	5.5373	451.12	-0.
210.00	1.2000	59399	200.46	2.2190	2214.1	-0.	185.67	.42029	1614.6	-0.	236.97	1.3459	133.78	-0.
211.00	1.1000	61258	222.00	3.8820	1624.4	-0.	267.39	3.2913	1202.4	-0.	259.10	5.3596	102.84	-0.
211.00	1.2000	61258	207.17	3.2631	2119.7	-0.	226.34	2.3097	1467.1	-0.	275.97	6.8324	76.068	-0.
212.00	1.1000	58236	175.69	1.3881	2890.4	-0.	177.03	1.0024	1721.2	-0.	240.72	6.0603	125.75	-0.
212.00	1.2000	58236	178.38	1.0603	3394.8	-0.	100.92	.37144	706.17	-0.	90.336	1.3854	46.789	-0.
213.00	1.1000	35385	60.203	.14804	2227.5	-0.	106.53	.42724	1026.7	-0.	193.77	2.5575	49.496	-0.
213.00	1.2000	35385	51.939	.15996	1512.4	-0.	117.67	.27904	1531.1	-0.	195.07	1.2127	88.599	-0.
214.00	1.1000	26114	229.82	1.0328	3720.7	-0.	302.51	2.6786	1849.5	-0.	397.43	9.2551	74.782	-0.
214.00	1.2000	26114	188.62	.36631	4176.3	-0.	276.90	1.6992	2317.6	-0.	270.05	5.4007	112.14	-0.
215.00	1.1000	60827	206.74	2.0595	2217.4	-0.	276.32	2.0516	1883.3	-0.	231.18	4.1281	129.99	-0.
215.00	1.2000	60827	151.74	1.7960	1915.4	-0.	155.77	1.1201	1121.9	-0.	150.40	2.6076	100.44	-0.
216.00	1.1000	39573	166.86	1.1884	2360.4	-0.	158.21	.76658	1322.7	-0.	183.54	.96416	320.21	-0.
216.00	1.2000	39573	235.95	1.7197	2941.0	-0.	233.23	.61380	2556.9	-0.	199.40	.72672	277.74	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
217.00	1.1000	19097	225.68	.14637	3960.0	-0.	293.17	.14021	3305.4	-0.	377.13	6.7065	104.02	-0.
217.00	1.2000	19097	206.10	.85707	3031.8	-0.	228.04	.12281	2731.5	-0.	188.36	.66169	173.76	-0.
218.00	1.1000	53782	137.57	1.4339	1719.3	-0.	150.88	.64290	1382.3	-0.	124.29	2.0810	109.28	-0.
218.00	1.2000	53782	147.38	1.4709	1763.3	-0.	155.33	.68287	1367.0	-0.	115.69	1.6739	52.125	-0.
219.00	1.1000	51291	166.63	2.2967	791.96	-0.	159.63	1.9144	495.77	-0.	152.64	2.2054	45.902	-0.
219.00	1.2000	51291	143.74	2.6153	785.36	-0.	145.12	1.9727	643.37	-0.	171.34	1.5215	101.92	-0.
220.00	1.1000	12724	185.90	.29767	4126.9	-0.	254.59	.48339	2992.9	-0.	203.66	5.3157	130.85	-0.
220.00	1.2000	12724	159.11	.24024	4056.6	-0.	208.85	.27160	3160.0	-0.	357.07	1.4607	921.45	-0.
221.00	1.1000	46554	31.092	.79164	1500.1	-0.	151.53	1.1572	925.28	-0.	132.82	.56617	98.297	-0.
221.00	1.2000	46554	166.12	.96036	1825.6	-0.	232.86	1.2299	1140.0	-0.	198.69	.82227	109.44	-0.
222.00	1.1000	12723	264.45	.87542	2377.6	-0.	329.03	.91649	794.47	-0.	284.01	1.9681	87.611	-0.
222.00	1.2000	12723	173.99	1.1038	4496.7	-0.	286.24	.84492	1861.6	-0.	312.63	5.6582	66.281	-0.
223.00	1.1000	34888	139.24	.24123	3063.3	-0.	208.41	.31069	2426.7	-0.	197.70	2.6072	145.21	-0.
223.00	1.2000	34888	108.72	.22880	2361.5	-0.	219.99	.50375	2564.6	-0.	171.41	.59548	243.84	-0.
224.00	1.1000	68569	189.97	.37152	2606.1	-0.	241.39	.57091	1502.3	-0.	177.87	2.6782	60.444	-0.
224.00	1.2000	68569	206.27	.73790	2735.3	-0.	313.56	2.1015	1303.2	-0.	294.13	3.5787	115.72	-0.
225.00	1.1000	49476	143.91	.22693	2743.5	-0.	145.25	.18347	827.80	-0.	130.53	1.6107	55.126	-0.
225.00	1.2000	49476	199.68	.34823	3153.5	-0.	293.80	.89593	1805.7	-0.	226.77	2.8550	141.94	-0.
226.00	1.1000	58888	168.37	.33836	2616.4	-0.	158.87	.21970	658.61	-0.	133.16	1.4587	91.656	-0.
226.00	1.2000	58888	104.46	.23403	1701.7	-0.	98.980	9.76305E-02	283.42	-0.	74.390	.63268	27.024	-0.
227.00	1.1000	47521	245.83	.16435	3176.0	-0.	354.80	.89398	1371.4	-0.	1094.6	2.7970	64.028	-0.
227.00	1.2000	47521	160.99	.12992	2749.2	-0.	215.89	.51397	1744.7	-0.	155.53	2.1344	94.629	-0.
228.00	1.1000	31541	141.43	.92102	4223.2	-0.	200.84	1.3322	2362.7	-0.	341.47	6.3698	103.43	-0.
228.00	1.2000	31541	127.80	1.5001	2696.7	-0.	220.44	2.5581	1386.8	-0.	407.04	7.8041	69.566	-0.
229.00	1.1000	12811	213.63	1.5862	2700.8	-0.	184.85	.38882	2262.4	-0.	168.72	4.5202	77.480	-0.
229.00	1.2000	12811	198.62	1.4940	2647.3	-0.	168.96	.48956	1806.4	-0.	111.53	.55470	258.85	-0.
230.00	1.1000	21185	178.24	1.1153	2111.7	-0.	258.11	.24166	2060.5	-0.	482.75	6.9792	119.54	-0.
230.00	1.2000	21185	211.44	.18001	2546.3	-0.	210.06	.12368	1053.5	-0.	232.14	1.9972	49.774	-0.
231.00	1.1000	25484	147.01	1.1365	2473.8	-0.	147.01	.34740	1877.5	-0.	136.27	3.4645	57.109	-0.
231.00	1.2000	25484	171.09	1.2450	2767.4	-0.	152.38	.25133	2019.6	-0.	137.73	2.1888	60.678	-0.
232.00	1.1000	25137	178.05	.37877	3677.0	-0.	253.11	.59191	2581.8	-0.	160.48	1.0441	164.40	-0.
232.00	1.2000	25137	216.05	.53684	4254.4	-0.	306.57	.86127	2946.0	-0.	286.94	4.2522	143.58	-0.
233.00	1.1000	54584	209.15	.27821	3973.5	-0.	243.10	.30977	2331.0	-0.	375.78	4.7689	111.19	-0.
233.00	1.2000	54584	207.68	.68650	3726.4	-0.	236.12	.30695	2932.7	-0.	389.25	6.4583	120.06	-0.
234.00	1.1000	42787	245.89	3.8980	1102.8	-0.	238.89	3.8471	90.908	-0.	862.28	5.1412	48.189	-0.
234.00	1.2000	42787	59.234	.32575	1593.2	-0.	63.686	.59986	346.93	-0.	66.415	.92621	36.544	-0.
235.00	1.1000	20301	126.42	.14590	3066.3	-0.	179.26	.14590	2281.4	-0.	267.21	6.1570	154.13	-0.
235.00	1.2000	20301	91.655	.17011	3204.4	-0.	116.83	.13944	1851.0	-0.	124.80	1.8945	135.59	-0.
236.00	1.1000	14976	247.42	1.7935	2621.0	-0.	252.90	.13379	2672.6	-0.	344.34	5.3740	119.77	-0.
236.00	1.2000	14976	179.85	1.0245	2824.1	-0.	156.14	9.19231E-02	2135.4	-0.	292.26	2.6661	171.87	-0.
237.00	1.1000	19286	225.72	1.7651	1849.9	-0.	228.49	1.1330	948.57	-0.	156.62	1.3910	51.522	-0.
237.00	1.2000	19285	215.67	1.6263	2268.5	-0.	284.16	1.1536	1855.5	-0.	238.85	.46898	259.29	-0.
238.00	1.1000	42111	265.50	3.4826	1760.6	-0.	317.85	3.3102	1502.8	-0.	291.60	4.7375	136.56	-0.
238.00	1.2000	42111	224.78	3.5291	1699.5	-0.	290.10	3.8508	1229.0	-0.	186.84	1.3140	115.96	-0.
239.00	1.1000	36397	177.56	1.0953	2453.8	-0.	185.78	.49511	1553.3	-0.	121.73	.65041	141.04	-0.
239.00	1.2000	36397	217.09	1.5369	2393.5	-0.	250.91	1.6976	1453.9	-0.	1980.0	1.4055	70.800	-0.
240.00	1.1000	46474	303.01	3.4095	1540.5	-0.	465.31	6.4899	301.86	-0.	625.67	9.6649	92.526	-0.
240.00	1.2000	46474	205.74	3.9402	1285.3	-0.	424.72	6.6978	250.29	-0.	898.69	8.9179	63.980	-0.
241.00	1.1000	37325	254.00	.69717	3028.5	-0.	269.19	.33716	1868.7	-0.	298.32	2.9380	160.63	-0.
241.00	1.2000	37325	193.81	1.0782	2463.4	-0.	220.32	.48696	1544.7	-0.	320.67	6.8524	121.18	-0.
242.00	1.1000	52910	184.14	.57550	2878.6	-0.	203.35	1.6186	719.25	-0.	131.03	.72800	42.374	-0.
242.00	1.2000	52910	208.83	1.3837	2885.2	-0.	340.19	3.1463	1214.7	-0.	430.00	5.0754	84.478	-0.
243.00	1.1000	73943	142.59	.28483	2510.2	-0.	173.54	.41859	1456.5	-0.	153.82	.75374	79.842	-0.
243.00	1.2000	73943	218.92	.59314	2832.0	-0.	280.86	1.9542	931.69	-0.	270.95	4.0571	118.33	-0.
244.00	1.1000	65233	204.77	.86842	2718.4	-0.	296.18	1.4569	1896.8	-0.	227.60	4.2877	44.068	-0.
244.00	1.2000	65233	201.37	.76794	3144.5	-0.	170.71	.60118	1142.5	-0.	192.99	2.2098	90.802	-0.
245.00	1.1000	29460	122.32	1.1331	2029.4	-0.	249.12	1.8937	834.20	-0.	331.67	8.0492	79.295	-0.
245.00	1.2000	29460	151.78	1.6379	3222.5	-0.	223.86	1.0573	2597.3	-0.	312.61	7.4784	97.853	-0.
246.00	1.1000	39895	171.85	.46875	2882.3	-0.	251.45	1.3964	1172.2	-0.	796.01	.13442	64.509	-0.
246.00	1.2000	39895	194.91	.47350	2705.7	-0.	274.79	1.1683	1333.6	-0.	132.75	1.2038	67.611	-0.
247.00	1.1000	48794	211.79	.16493	3534.1	-0.	273.99	.74314	2084.8	-0.	223.04	1.1486	283.08	-0.
247.00	1.2000	48794	143.00	.13474	2175.5	-0.	216.77	.50881	1929.7	-0.	216.77	1.1686	164.38	-0.
248.00	1.1000	56334	183.97	.41238	2998.8	-0.	294.51	1.6487	1685.5	-0.	298.87	4.1657	117.34	-0.
248.00	1.2000	56334	190.77	.59899	3205.2	-0.	300.49	1.9280	1892.4	-0.	243.19	1.9280	173.37	-0.
249.00	1.1000	1.02571E+05	271.76	1.9044	2086.6	-0.	325.04	2.0071	1159.8	-0.	280.36	2.1275	87.949	-0.
249.00	1.2000	1.02571E+05	215.24	1.6639	2233.6	-0.	307.74	2.5373	1449.1	-0.	270.54	2.3340	143.07	-0.

51

TABLE 1

SUMMARY OF TEST DATA

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
250.00	1.1000	24272	238.19	.47466	2840.8	-0.	384.76	1.4019	2024.4	-0.	1102.8	10.332	70.383	-0.
250.00	1.2000	24272	144.70	.28225	2793.5	-0.	266.94	1.4826	2045.7	-0.	273.97	4.1667	135.27	-0.
251.00	1.1000	20003	238.21	.46883	4595.6	-0.	298.15	.28397	3547.1	-0.	404.08	4.3523	134.47	-0.
251.00	1.2000	20003	182.32	.51957	3941.3	-0.	200.65	.15266	2680.6	-0.	226.13	2.9422	248.90	-0.
252.00	1.1000	14945	151.12	1.7943	2936.8	-0.	171.71	1.3986	1044.0	-0.	193.77	2.1078	89.508	-0.
252.00	1.2000	14945	99.620	.97092	2893.9	-0.	102.34	.50178	1271.0	-0.	132.36	3.0175	72.536	-0.
253.00	1.1000	64943	176.27	.15333	3386.1	-0.	228.00	.60714	1946.7	-0.	520.32	3.2737	67.933	-0.
253.00	1.2000	64943	145.66	.15840	2994.9	-0.	222.96	.24513	2429.0	-0.	555.32	.78825	315.12	-0.
254.00	1.1000	22610	158.47	.19373	3894.8	-0.	258.88	.91347	2818.0	-0.	158.47	1.0588	271.80	-0.
254.00	1.2000	22610	165.47	.24601	3807.6	-0.	280.35	1.1573	3026.9	-0.	560.73	.50057	222.31	-0.
255.00	1.1000	66173	174.36	2.3695	961.36	-0.	178.52	.50486	1125.6	-0.	178.52	2.8843	70.716	-0.
255.00	1.2000	66173	175.75	3.3986	473.62	-0.	209.14	.51667	1648.7	-0.	269.54	2.5157	82.868	-0.
256.00	1.1000	11099	145.35	.59107	2704.6	-0.	152.38	.46769	1408.6	-0.	191.92	2.7100	87.737	-0.
256.00	1.2000	11099	95.176	.47203	2561.8	-0.	180.86	2.3315	1269.7	-0.	162.48	1.8981	208.63	-0.
257.00	1.1000	26789	130.99	.20883	2818.4	-0.	137.84	.17774	934.65	-0.	58.993	.34084	117.76	-0.
257.00	1.2000	26789	143.21	.19521	2925.7	-0.	169.57	.17053	1060.0	-0.	191.87	5.0353	95.089	-0.
258.00	1.1000	26521	227.32	1.6957	2405.6	-0.	309.26	2.9404	1164.1	-0.	211.93	1.3237	254.15	-0.
258.00	1.2000	26521	224.15	1.1388	3096.3	-0.	219.82	1.3821	1396.8	-0.	171.08	1.1107	180.46	-0.
259.00	1.1000	81903	613.50	1.8971	2359.4	-0.	1407.7	7.4817	328.31	-0.	2037.5	13.198	86.281	-0.
259.00	1.2000	81903	206.92	.97535	1994.9	-0.	295.62	1.1358	1450.8	-0.	409.51	8.0817	76.301	-0.
260.00	1.1000	23524	100.69	.86494	3834.0	-0.	168.96	1.9468	2460.4	-0.	249.35	6.1661	113.80	-0.
260.00	1.2000	23524	118.20	4.0031	1123.6	-0.	195.29	4.1067	1061.4	-0.	240.70	8.1212	61.121	-0.
261.00	1.1000	22861	142.37	.35440	4379.8	-0.	174.11	.31627	2282.6	-0.	250.83	4.3115	130.74	-0.
261.00	1.2000	22861	145.02	.51687	3940.8	-0.	167.28	.62739	2162.3	-0.	223.37	4.7114	122.32	-0.
262.00	1.1000	17020	413.93	8.6668	304.40	-0.	409.59	5.5078	570.09	-0.	485.42	6.5487	85.170	-0.
262.00	1.2000	17020	337.57	7.1012	556.62	-0.	317.33	2.9298	1455.0	-0.	376.86	4.3599	104.43	-0.
263.00	1.1000	25176	189.92	.64471	3324.8	-0.	302.00	1.3991	1428.2	-0.	435.79	9.5982	67.772	-0.
263.00	1.2000	25176	133.53	.20534	4097.9	-0.	224.12	.90674	2355.6	-0.	207.27	5.5984	107.68	-0.
264.00	1.1000	37737	147.23	.20893	3105.2	-0.	325.87	2.0492	1925.9	-0.	423.45	8.9466	83.162	-0.
264.00	1.2000	37737	128.01	.22163	2828.8	-0.	246.67	1.2752	2391.5	-0.	250.91	3.9445	190.56	-0.
265.00	1.1000	51796	208.19	.72349	3392.9	-0.	201.16	.67032	1260.5	-0.	152.19	.87172	152.34	-0.
265.00	1.2000	51796	165.72	.52272	3084.1	-0.	297.70	.95981	2057.5	-0.	271.96	7.1953	108.71	-0.
266.00	1.1000	56340	105.39	.45013	1400.7	-0.	112.31	.43107	534.04	-0.	196.77	.60436	27.276	-0.
266.00	1.2000	56340	1718.3	1.6150	1169.6	-0.	1710.5	1.9134	618.62	-0.	1508.3	2.2326	49.099	-0.
267.00	1.1000	40072	159.90	.45433	2062.8	-0.	187.96	.14230	1324.3	-0.	227.49	3.8640	175.70	-0.
267.00	1.2000	40072	171.09	.43709	1686.8	-0.	155.44	.17177	717.05	-0.	405.56	5.8725	79.704	-0.
268.00	1.1000	51561	179.85	1.6776	1721.9	-0.	226.19	.88228	1976.1	-0.	285.81	6.0100	119.49	-0.
268.00	1.2000	51561	215.07	1.7924	2848.9	-0.	243.46	.67958	3120.1	-0.	292.07	4.2761	139.62	-0.
269.00	1.1000	42523	214.28	.57566	2505.1	-0.	245.26	.47760	1305.6	-0.	349.44	[illegible]	[illegible]	-0.
269.00	1.2000	42523	219.99	.31620	3122.9	-0.	247.05	.72790	1675.1	-0.	262.78	4.0542	87.035	-0.
270.00	1.1000	27635	243.76	2.0166	2427.4	-0.	331.84	1.1549	2569.6	-0.	229.69	5.0625	161.64	-0.
270.00	1.2000	27635	218.11	.73597	3406.3	-0.	251.03	.17091	3949.2	-0.	140.20	.14625	197.47	-0.
271.00	1.1000	17345	119.66	.22970	2791.3	-0.	196.70	1.1193	1908.5	-0.	206.58	2.7045	107.47	-0.
271.00	1.2000	17345	98.025	.19309	2213.2	-0.	169.56	.63504	1650.0	-0.	1971.4	1.1837	180.74	-0.
272.00	1.1000	40191	185.04	.33949	3594.5	-0.	280.74	.41384	2716.0	-0.	341.07	5.6326	209.12	-0.
272.00	1.2000	40191	199.16	.56725	3261.4	-0.	298.02	.69960	2212.7	-0.	308.00	1.0404	477.64	-0.
273.00	1.1000	15714	135.81	1.4833	2679.7	-0.	208.13	1.6042	1692.5	-0.	248.16	7.7593	93.446	-0.
273.00	1.2000	15714	149.83	2.7258	798.55	-0.	130.95	1.9296	641.72	-0.	143.65	1.7355	167.96	-0.
274.00	1.1000	76117	1373.7	.63216	2669.4	-0.	1523.0	1.0546	2005.9	-0.	1634.1	5.0492	88.083	-0.
274.00	1.2000	76117	229.99	.82492	2754.2	-0.	317.03	1.8151	1467.9	-0.	328.56	6.7494	96.951	-0.
275.00	1.1000	14183	273.84	.74933	3430.8	-0.	283.89	.88770	1556.3	-0.	253.81	1.4158	182.08	-0.
275.00	1.2000	14183	297.52	.92423	3618.6	-0.	336.07	1.2047	1999.9	-0.	520.61	2.0353	1294.4	-0.
276.00	1.1000	33664	156.20	1.7581	2884.7	-0.	179.68	1.5966	1216.2	-0.	181.06	3.4340	114.38	-0.
276.00	1.2000	33664	123.05	.92087	3035.9	-0.	162.70	1.7311	859.46	-0.	190.78	3.3650	115.99	-0.
277.00	1.1000	76193	219.21	.13669	4190.0	-0.	266.45	.11164	2805.5	-0.	246.36	.40477	239.81	-0.
277.00	1.2000	76193	206.25	.31687	3664.8	-0.	242.11	.98024	2188.9	-0.	292.45	1.8631	118.04	-0.
278.00	1.1000	55179	291.76	1.5242	2672.9	-0.	436.48	3.2326	1542.2	-0.	753.71	6.9350	80.716	-0.
278.00	1.2000	55179	257.94	1.5981	2660.5	-0.	456.50	2.5600	1624.4	-0.	698.63	5.7072	96.587	-0.
279.00	1.1000	52128	141.19	.22098	3148.5	-0.	120.19	.17130	1186.7	-0.	257.44	4.1910	133.56	-0.
279.00	1.2000	52128	185.53	.55715	3133.0	-0.	214.94	.35297	1817.8	-0.	324.27	3.6289	150.32	-0.
280.00	1.1000	30897	172.90	2.2840	1753.7	-0.	189.93	.78104	2111.5	-0.	313.60	.51368	83.596	-0.
280.00	1.2000	30897	201.32	4.0279	1068.2	-0.	296.17	8.1305	525.61	-0.	869.49	8.3151	80.751	-0.
281.00	1.1000	55635	190.66	1.2887	1124.5	-0.	165.08	.97093	860.87	-0.	149.60	2.2090	152.79	-0.
281.00	1.2000	55635	141.81	1.7651	1165.3	-0.	202.74	1.6493	859.73	-0.	179.99	3.3452	86.383	-0.
282.00	1.1000	63299	191.08	.98387	2489.0	-0.	300.26	2.0290	1111.4	-0.	329.75	6.3623	133.55	-0.
282.00	1.2000	63299	183.33	1.1671	2471.4	-0.	271.56	2.7859	988.04	-0.	292.02	3.3348	274.77	-0.

52

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 2 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
283.00	1.1000	61965	145.28	.88842	2756.8	-0.	196.59	.71942	1982.2	-0.	170.83	1.9523	154.51	-0.
283.00	1.2000	61965	106.71	.44765	2906.8	-0.	158.75	.17708	2248.8	-0.	170.07	1.3745	184.81	-0.
284.00	1.1000	28963	170.77	.50394	3743.5	-0.	183.54	.42606	2596.4	-0.	330.36	6.4977	98.322	-0.
284.00	1.2000	28963	136.18	.63171	3740.1	-0.	144.63	.41514	2565.0	-0.	254.29	5.1651	130.09	-0.
285.00	1.1000	21528	113.71	.16511	2724.7	-0.	189.93	.16511	3132.4	-0.	218.44	2.8626	120.35	-0.
285.00	1.2000	21528	105.92	.13551	3549.4	-0.	191.34	.38839	2731.8	-0.	208.31	2.5949	121.91	-0.
286.00	1.1000	49323	184.29	3.5820	735.19	-0.	213.98	2.4596	624.33	-0.	122.62	2.9498	52.069	-0.
286.00	1.2000	49323	173.68	2.5834	1129.2	-0.	213.69	2.1908	710.75	-0.	128.32	2.2480	45.226	-0.
287.00	1.1000	25220	150.12	1.8641	1703.0	-0.	186.56	1.7870	1012.5	-0.	231.74	9.1668	98.669	-0.
287.00	1.2000	25220	185.67	1.8411	2216.4	-0.	198.47	1.1026	1765.0	-0.	198.47	3.2001	220.28	-0.
288.00	1.1000	44070	206.40	.32689	3022.9	-0.	256.39	.45406	2069.6	-0.	195.04	.78184	111.46	-0.
288.00	1.2000	44070	184.25	.29833	2830.2	-0.	245.66	.29833	1943.8	-0.	207.02	2.9786	102.99	-0.
289.00	1.1000	-0.	106.84	.65172	2252.5	-0.	134.58	.35715	1246.3	-0.	264.06	2.7157	61.627	-0.
289.00	1.2000	-0.	122.85	.76253	2050.4	-0.	189.65	.42985	1917.4	-0.	203.96	2.2320	113.14	-0.
290.00	1.1000	69383	138.21	.23026	3532.0	-0.	185.08	.37063	2297.2	-0.	155.20	2.0949	141.29	-0.
290.00	1.2000	69383	129.73	.48035	2968.4	-0.	172.25	.64538	1743.1	-0.	138.21	1.7283	125.76	-0.
291.00	1.1000	18753	222.82	1.1315	3660.9	-0.	294.39	.67012	3082.1	-0.	365.47	8.1516	91.192	-0.
291.00	1.2000	18753	180.87	1.1478	3081.2	-0.	178.04	.13495	3037.5	-0.	334.45	2.0114	143.14	-0.
292.00	1.1000	55768	142.24	1.6092	2018.7	-0.	125.31	1.8479	355.96	-0.	132.36	3.1905	55.837	-0.
292.00	1.2000	55768	151.40	1.4148	2349.2	-0.	147.14	1.7917	983.98	-0.	144.30	2.3534	78.895	-0.
293.00	1.1000	47310	182.28	1.0455	3517.0	-0.	279.40	1.8028	2077.5	-0.	273.64	4.2617	123.26	-0.
293.00	1.2000	47310	187.09	.85001	3039.1	-0.	217.01	.91906	1459.2	-0.	160.16	1.4958	187.98	-0.
294.00	1.1000	56745	122.26	.64302	3434.3	-0.	185.15	2.2550	2108.3	-0.	295.94	7.2676	117.13	-0.
294.00	1.2000	56745	122.49	2.0007	2488.2	-0.	207.64	3.7970	1102.9	-0.	250.73	5.9767	133.49	-0.
295.00	1.1000	37652	162.06	1.3639	2831.6	-0.	262.27	2.5848	1628.8	-0.	305.80	5.4637	83.209	-0.
295.00	1.2000	37652	167.48	1.1833	3739.8	-0.	218.77	.80143	2819.2	-0.	130.75	9.78989E-0	125.31	-0.
296.00	1.1000	23661	245.94	1.2002	2909.6	-0.	241.68	.69473	1883.5	-0.	298.81	4.6720	134.25	-0.
296.00	1.2000	23661	268.46	1.5664	3188.2	-0.	277.17	.73540	2427.9	-0.	284.43	1.7953	283.44	-0.
297.00	1.1000	29228	149.38	.38217	4174.5	-0.	201.53	.31816	3837.2	-0.	217.13	2.0302	151.28	-0.
297.00	1.2000	29228	149.53	.59630	4256.2	-0.	175.10	.33670	3155.7	-0.	167.99	1.9704	254.35	-0.
298.00	1.1000	55822	170.83	1.4195	2501.1	-0.	219.43	1.1942	1940.7	-0.	199.36	2.6605	120.94	-0.
298.00	1.2000	55822	139.00	1.2437	2201.9	-0.	189.93	1.4185	1380.5	-0.	153.10	2.1133	136.95	-0.
299.00	1.1000	90752	146.70	1.5062	1453.6	-0.	203.66	1.7093	490.60	-0.	370.86	3.5020	92.794	-0.
299.00	1.2000	90752	155.00	1.2877	2079.3	-0.	176.10	1.9902	872.28	-0.	294.39	6.7640	90.402	-0.
300.00	1.1000	23585	170.83	.86527	2120.7	-0.	277.17	3.1279	1098.9	-0.	328.20	8.8586	96.609	-0.
300.00	1.2000	23585	173.16	.73454	2619.1	-0.	266.21	1.5645	1860.9	-0.	273.43	3.0639	120.36	-0.
ESTIMATE OF MEAN			203.65	1.2496	2622.9	0.	262.37	1.4386	1661.8	0.	342.86	3.6778	133.36	0.
ESTIMATE OF STANDARD DEVIATION			237.24	1.3423	966.90	-0.	251.53	1.4323	828.17	-0.	441.69	2.4648	112.24	-0.
DEGREES OF FREEDOM			297	299	299	0	298	299	299	0	298	299	299	0
T VALUE			14.819	16.111	46.985	-0.	18.037	17.397	34.755	-0.	13.422	25.844	20.579	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
151.00	2.0000	35119	123.33	.57211	3929.9	3750.6	160.04	1.3732	2215.7	2040.1	281.47	6.6482	96.032	533.34
152.00	2.0000	76205	68.621	4.5409	231.49	72.251	32.774	.80563	468.21	247.95	28.498	.28821	154.84	19.743
153.00	2.0000	67030	175.64	.55186	3512.1	3384.9	283.77	1.5754	2298.9	2006.1	363.20	8.0518	101.65	44.499
154.00	2.0000	64263	295.82	4.8159	-0.	729.19	397.53	6.4385	-0.	129.86	603.54	10.105	-0.	13.044
155.00	2.0000	80497	147.31	1.5141	2456.2	2299.9	213.57	2.9573	1047.7	873.72	161.97	3.8291	110.19	58.445
156.00	2.0000	16483	183.16	.52238	4278.6	4054.5	190.59	.17218	3043.9	2827.1	187.57	2.2938	217.84	148.75
157.00	2.0000	36383	129.77	.49269	3665.7	3644.6	181.08	.35041	2901.0	2703.6	156.10	2.2096	176.53	148.28
158.00	2.0000	28489	147.31	2.1412	2840.0	2672.2	429.57	1.5123	1356.6	1144.3	173.72	1.2416	82.573	19.624
159.00	2.0000	22718	159.79	1.3451	2984.8	2788.8	123.06	.26903	1951.0	1796.2	120.13	3.5912	198.57	194.06
160.00	2.0000	70432	215.65	1.3368	2614.0	2274.1	331.21	1.8674	1539.9	1409.4	509.21	1.4622	91.735	45.395
161.00	2.0000	5258.0	184.37	1.8444	3049.6	2921.4	245.76	.89961	2675.7	2583.4	294.47	6.7257	99.025	39.329
162.00	2.0000	22894	109.22	.12427	-0.	3851.7	207.32	.41164	-0.	3222.6	173.45	2.2053	-0.	143.33
163.00	2.0000	84817	276.49	3.4765	-0.	1341.4	391.08	4.3985	-0.	705.21	316.93	4.9880	-0.	58.156
164.00	2.0000	67236	247.75	5.3036	-0.	885.05	286.64	5.2822	-0.	169.11	2360.0	7.0191	-0.	26.159
165.00	2.0000	31062	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
166.00	2.0000	88310	270.39	4.7260	-0.	1182.3	531.71	8.0191	-0.	295.43	2200.0	11.060	-0.	19.474
167.00	2.0000	57884	118.48	.81209	-0.	3626.6	184.60	.89423	-0.	1980.2	429.41	6.1678	-0.	26.025
168.00	2.0000	48098	240.30	3.5425	-0.	1703.5	322.78	3.4436	-0.	1343.5	330.34	8.1382	-0.	32.927
169.00	2.0000	16388	169.45	.27678	-0.	3910.2	210.44	.43840	-0.	1882.6	122.98	1.1168	-0.	70.909
170.00	2.0000	51759	36.078	.16213	-0.	1305.6	41.872	.12440	-0.	447.54	211.12	-0.	-0.	32.045
171.00	2.0000	68667	243.76	4.3334	-0.	1014.3	310.92	4.0160	-0.	389.55	394.13	5.8100	-0.	32.380
172.00	2.0000	60428	84.642	.21439	-0.	2348.7	254.96	2.6192	-0.	1681.1	275.85	4.2922	-0.	110.25
173.00	2.0000	49307	110.22	2.0822	-0.	1174.5	120.35	1.9234	-0.	756.29	94.330	1.0941	-0.	52.266
174.00	2.0000	36643	120.53	1.1835	-0.	2430.8	186.20	2.5985	-0.	759.38	218.60	4.6377	-0.	33.082
175.00	2.0000	57769	312.91	10.479	-0.	71.309	253.06	.32872	-0.	2937.3	272.44	4.3449	-0.	103.59
176.00	2.0000	71064	127.71	.87982	-0.	3315.4	183.78	.64503	-0.	2700.0	107.19	.27146	-0.	145.06
177.00	2.0000	84571	95.062	2.3005	2536.1	2433.4	93.609	2.0820	1561.9	1434.3	175.55	1.6182	82.849	45.556
178.00	2.0000	12022	119.54	.73052	3353.7	3323.5	192.66	1.8049	1270.8	1194.9	229.35	4.3484	102.22	51.899
179.00	2.0000	40423	148.30	.21612	-0.	3268.8	238.93	.29801	-0.	2711.1	127.71	9.80250E-02	-0.	95.441
180.00	2.0000	57856	113.98	.35714	-0.	2660.7	815.66	1.3847	-0.	1186.1	131.50	2.4715	-0.	39.195
181.00	2.0000	95620	100.35	1.7907	1402.0	1282.8	148.99	4.3292	312.43	246.79	174.22	4.4324	98.257	57.785
182.00	2.0000	25507	203.82	.33926	4297.4	4222.1	320.91	1.7340	2454.4	2363.4	291.78	4.3263	137.84	25.462
183.00	2.0000	48784	164.73	.32376	3254.8	3245.4	293.84	1.3441	2029.2	2039.3	257.92	3.5309	122.45	52.871
184.00	2.0000	92616	166.01	.95617	3012.4	3062.0	312.82	3.2421	1364.8	1256.8	288.58	4.9250	120.22	78.989
185.00	2.0000	17662	179.97	.70965	3695.3	3482.6	225.90	1.6975	2205.3	2066.6	212.53	3.6637	130.42	86.226
186.00	2.0000	81587	122.87	1.1673	4186.5	4119.1	275.21	5.2872	1058.1	949.52	425.76	8.6894	62.535	19.760
187.00	2.0000	21498	107.19	.21080	3534.4	3631.6	209.12	.13572	3411.6	3387.4	534.30	10.031	91.468	32.861
190.00	2.0000	61989	121.84	1.4583	2062.0	1913.5	167.49	1.1959	1687.9	1515.2	194.17	2.8024	99.455	59.794
191.00	2.0000	57231	146.71	1.6254	1847.6	1806.1	171.54	1.1974	1501.5	1484.1	196.49	1.4750	171.33	115.56
193.00	2.0000	63392	185.03	.36069	2827.5	2752.1	154.25	.65311	1049.9	939.02	155.72	1.8670	128.31	84.798
194.00	2.0000	60759	275.00	3.6105	2065.3	1947.1	368.28	5.5761	716.00	571.35	3030.0	10.719	108.83	13.278
196.00	2.0000	27838	209.42	1.8678	2621.4	-0.	263.36	.73056	2657.1	-0.	147.95	.86525	285.39	-0.
197.00	2.0000	88099	318.82	4.7478	1320.1	-0.	508.76	6.7155	551.49	-0.	309.72	2.5820	175.15	-0.
198.00	2.0000	47370	176.48	1.6316	2917.0	2981.9	197.10	1.7935	1746.5	1432.8	169.13	3.2993	100.66	45.461
199.00	2.0000	54019	100.28	.26005	3523.3	3557.9	237.81	5.1157	799.40	392.66	462.93	6.8523	82.288	45.671
200.00	2.0000	58113	178.33	1.7105	2765.2	-0.	191.50	2.0942	1006.2	-0.	275.60	5.7045	179.74	-0.
202.00	2.0000	64436	113.98	.36754	4461.0	4262.9	156.42	.19710	2859.7	2725.3	306.82	1.1545	267.29	199.58
204.00	2.0000	53859	149.55	1.0473	3713.5	-0.	216.16	2.0014	1765.1	-0.	179.06	5.0382	114.31	-0.
205.00	2.0000	38185	158.88	2.3383	2271.4	2234.5	253.42	3.7761	1094.6	1021.8	685.16	7.8065	77.320	33.094
206.00	2.0000	25624	108.17	1.8414	1585.5	-0.	137.37	1.7411	1010.3	-0.	124.21	2.1345	98.667	-0.
207.00	2.0000	49018	136.12	1.8293	2223.3	2162.7	153.55	2.8628	820.31	732.53	163.74	2.3026	188.18	135.85
208.00	2.0000	61983	233.75	.52116	3264.3	3140.0	264.46	.27516	1955.0	1719.3	291.78	1.8644	258.98	202.75
209.00	2.0000	60162	215.31	.27294	2913.9	3640.8	375.16	.31623	1965.1	1822.1	1062.4	1.2033	268.77	164.30
210.00	2.0000	66862	220.53	1.6555	2810.3	2726.3	264.80	.65450	2282.9	2210.5	313.90	.68778	231.71	175.17
211.00	2.0000	65895	202.38	3.0447	2257.9	2150.2	239.29	2.3968	1693.9	1677.9	381.82	8.2670	89.582	52.117
213.00	2.0000	39047	25.772	.15779	3114.6	1946.7	116.92	.46458	3441.9	1967.7	206.59	1.4325	209.43	71.652
214.00	2.0000	28956	180.90	.44185	4207.6	3980.6	272.82	1.4800	2619.9	2523.1	286.29	5.8492	130.16	90.282
215.00	2.0000	-0.	148.41	1.4238	2957.5	2938.5	207.12	.97536	3022.3	3037.2	163.03	2.2520	206.60	172.71
216.00	2.0000	44143	192.67	1.5669	3143.0	3110.0	204.38	.49299	3096.5	3044.3	140.26	.49299	339.95	294.61
217.00	2.0000	25237	180.46	.15959	4022.5	4067.8	257.01	.13490	3306.9	3513.4	178.97	1.3414	262.01	213.68
218.00	2.0000	56598	121.63	1.1397	2339.7	2139.5	152.09	.57423	1880.2	1754.7	121.63	3.0679	150.32	51.762
219.00	2.0000	54787	106.08	2.5624	883.22	743.20	113.52	2.2626	541.15	438.21	164.38	2.3943	110.24	66.331
220.00	2.0000	17526	161.07	.44237	3961.7	3894.8	249.73	1.0015	2529.3	2469.1	366.07	2.7659	455.46	387.83
221.00	2.0000	51699	82.526	1.1094	2646.5	1500.1	151.49	1.4110	1712.8	937.34	173.68	.86029	335.00	84.651
222.00	2.0000	15152	129.86	.82100	4018.0	4051.7	144.47	.83457	1448.6	1365.7	270.25	5.5997	82.785	39.331
223.00	2.0000	43039	83.470	.34689	2550.2	2518.9	171.14	1.1921	2313.5	2257.6	222.91	4.7258	136.03	110.78

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
224.00	2.0000	73642	136.54	.45727	2062.3	1926.8	192.69	.73759	1264.3	1115.7	168.90	1.9701	104.02	78.048
225.00	2.0000	54464	109.91	.26583	2974.7	2922.2	239.67	1.0833	1858.1	1700.6	207.31	3.9531	136.25	91.357
226.00	2.0000	63147	147.40	.74171	2780.6	2760.1	110.92	1.7187	373.25	330.92	71.775	1.6955	55.714	38.631
227.00	2.0000	50594	146.28	.13749	3374.2	3074.3	203.22	.74849	2099.7	1835.1	185.64	3.7835	61.404	53.184
228.00	2.0000	35806	94.646	1.3443	3275.8	3270.5	135.28	.81820	2722.2	2698.9	253.03	5.8663	106.40	78.345
229.00	2.0000	-0.	178.88	1.4753	3095.6	2952.7	171.56	.71780	2583.0	2514.5	90.176	1.2070	333.40	267.64
231.00	2.0000	-0.	102.67	.85479	2830.6	2826.2	140.73	.52592	2558.4	2521.2	187.94	5.8745	123.79	78.647
232.00	2.0000	29122	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
233.00	2.0000	62351	146.34	.65542	3542.7	3472.0	186.46	.49600	2589.5	2514.8	367.92	8.0106	112.24	44.033
234.00	2.0000	45740	108.47	.14141	3439.7	3489.3	112.85	.17875	1217.4	1144.0	83.697	.38752	100.76	96.895
235.00	2.0000	22999	45.830	.14821	2744.9	2674.9	68.885	.17946	1541.7	1481.8	109.46	2.8928	135.56	91.241
236.00	2.0000	21495	179.98	1.4343	3047.9	-0.	168.20	.12351	2753.5	-0.	197.71	1.6989	251.75	-0.
237.00	2.0000	23500	223.61	2.6381	1799.9	1713.8	274.52	1.2206	1855.4	1747.3	214.67	.31526	285.83	232.45
238.00	2.0000	44083	177.96	3.2649	1810.0	1730.1	225.19	3.1988	1344.8	1234.0	153.03	1.4251	118.59	83.403
239.00	2.0000	41150	469.58	7.7997	320.92	242.54	895.12	9.6106	88.299	32.181	2630.0	9.0114	96.429	12.882
240.00	2.0000	48995	112.03	2.5284	1127.4	1007.5	359.64	5.9144	317.15	240.37	1375.0	10.504	89.284	19.655
241.00	2.0000	41076	79.245	.61322	2170.5	2092.0	86.504	.28754	1069.1	1002.1	241.15	6.4282	167.10	117.57
242.00	2.0000	64773	160.35	.95034	3112.6	2972.1	231.13	2.0723	1277.0	1157.8	73.108	2.0965	83.914	51.858
245.00	2.0000	36175	98.441	1.7167	3195.8	3222.1	185.27	1.7167	2117.0	2021.4	507.20	11.378	64.152	19.621
246.00	2.0000	49452	83.599	.41175	2701.3	2583.4	109.80	1.1744	896.20	842.57	43.086	.85443	71.968	58.012
247.00	2.0000	55825	113.31	.42707	4011.4	3961.8	190.62	1.7694	1942.2	1869.1	181.81	1.4511	165.06	117.06
248.00	2.0000	62637	164.34	.74679	3349.7	3283.3	309.11	2.8659	1575.9	1468.2	278.64	4.2745	138.38	84.320
250.00	2.0000	26848	143.37	.26362	3067.0	3065.1	235.61	.75894	2406.5	2345.5	251.87	2.8868	224.15	193.54
251.00	2.0000	22802	183.47	.39323	4499.9	4379.8	198.17	.17221	2935.3	2947.6	236.58	3.9904	159.26	115.07
252.00	2.0000	17411	133.83	1.4781	3430.6	3409.6	132.37	1.4707	1368.5	1350.1	149.87	4.2788	108.96	71.528
254.00	2.0000	25418	163.78	.29193	3956.6	3935.9	297.72	1.8115	2324.6	2365.5	233.33	3.3415	183.22	130.09
255.00	2.0000	73233	167.76	1.7937	1535.1	1246.6	219.82	.82252	1496.9	1223.0	160.36	2.5681	94.419	45.825
256.00	2.0000	13528	73.735	.40505	3123.4	3009.6	164.31	2.2496	1433.1	1293.2	134.40	1.5341	253.36	197.40
257.00	2.0000	35013	121.29	.30314	2731.5	2644.5	147.63	.26535	1226.7	1044.6	193.27	6.2995	120.39	45.855
258.00	2.0000	27233	154.18	1.4366	2956.3	2989.9	193.76	1.5555	1894.8	1819.3	158.56	1.4588	229.96	175.20
259.00	2.0000	86020	188.75	.82199	3320.7	3379.9	255.08	.88334	2598.0	2661.0	323.69	6.9512	119.59	78.409
260.00	2.0000	25103	75.841	.92851	3010.3	2949.4	164.41	1.3116	2408.2	2393.2	123.58	2.5270	163.26	104.44
261.00	2.0000	25957	129.60	.46517	4438.3	4297.5	179.34	1.0591	2793.8	2602.2	231.01	5.2491	133.59	70.362
262.00	2.0000	21895	162.46	.95215	3411.9	3261.7	194.18	1.1442	1852.6	1718.8	150.98	2.4489	159.66	64.655
263.00	2.0000	34229	51.723	.16599	2677.1	2575.0	69.070	.41249	1290.2	1203.9	162.50	5.8593	128.95	65.042
265.00	2.0000	58136	183.51	.54322	3296.3	3136.5	299.13	.81320	2339.9	2192.9	284.52	6.9922	121.13	79.425
267.00	2.0000	45001	156.83	.40258	2624.0	2430.0	201.48	.37637	2197.5	1971.5	214.52	2.0297	153.79	108.80
268.00	2.0000	57624	187.04	1.5980	-0.	3350.9	217.66	.72285	-0.	2939.0	280.92	6.3701	-0.	73.236
269.00	2.0000	45883	257.02	.22693	3886.7	3750.1	340.58	1.5145	1692.8	1543.1	422.45	7.3911	115.20	93.620
270.00	2.0000	32769	144.70	.58993	4346.4	4367.1	170.40	.12438	4135.9	4131.4	113.45	.11185	156.85	138.20
271.00	2.0000	24702	93.536	.28791	3089.3	3043.7	165.53	1.1094	2066.0	1937.9	146.72	2.2515	221.07	109.31
272.00	2.0000	44117	169.83	.31243	3889.0	3807.8	226.84	.29332	3113.8	2963.5	276.66	.92345	529.83	447.19
273.00	2.0000	19897	121.65	.69501	3473.3	3352.3	135.98	.20565	2501.0	2400.5	222.81	1.9938	378.91	323.12
274.00	2.0000	81842	181.87	.45411	2898.5	1619.5	238.12	1.1339	1440.3	729.15	189.04	2.8519	110.72	38.835
275.00	2.0000	19240	257.15	.39113	3870.8	3914.1	279.16	.39113	2172.1	2187.7	429.87	.68827	798.64	756.30
277.00	2.0000	80469	212.94	.52622	2632.3	3163.7	292.32	.81755	2177.1	2012.2	299.73	1.8049	144.48	86.233
278.00	2.0000	58847	248.67	1.3360	2789.6	2757.8	420.31	2.7308	1674.5	1544.5	695.22	5.5088	82.966	43.838
279.00	2.0000	55604	182.68	.50122	3353.8	3194.9	200.14	.30742	2001.2	1876.7	313.59	4.5859	149.57	71.456
280.00	2.0000	35370	180.75	2.8813	1555.5	1478.0	253.97	3.9214	727.96	619.12	697.46	6.9407	78.398	14.701
281.00	2.0000	60470	154.43	1.4256	1446.8	1290.2	202.11	1.0221	1058.4	923.81	154.43	2.3371	91.176	57.778
282.00	2.0000	70556	206.46	2.4677	2096.5	1949.5	276.66	3.6180	883.63	766.01	270.77	6.9347	102.42	50.481
283.00	2.0000	67788	136.83	.99640	2655.2	2474.3	170.15	.21952	2091.3	1930.0	175.97	1.8310	146.01	78.280
284.00	2.0000	34984	163.50	.39583	3988.1	3891.0	180.71	.40228	2579.2	2444.6	239.95	4.1764	166.36	122.57
285.00	2.0000	23804	106.09	.16637	3287.9	3240.3	180.94	1.0933	2171.5	2070.5	178.05	2.8015	113.26	71.614
286.00	2.0000	53735	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
287.00	2.0000	35307	191.06	1.4571	2356.5	2273.7	173.79	.65989	1571.0	1453.6	163.74	1.7453	521.82	360.53
288.00	2.0000	49007	199.63	.34633	2787.8	2539.2	228.37	1.1981	1265.8	1055.2	218.29	3.4801	82.437	43.765
289.00	2.0000	40999	151.29	.01840	2702.3	2496.7	238.09	.75922	1965.7	1770.8	188.73	2.2430	118.27	63.670
290.00	2.0000	72506	137.35	.41198	4009.9	3990.7	190.17	.94500	2390.2	2390.5	194.48	3.2965	71.102	28.802
291.00	2.0000	23701	190.23	.99648	3590.8	3563.1	207.74	.14787	3488.8	3407.4	146.71	2.1044	108.20	57.612
292.00	2.0000	59473	163.06	1.3560	2414.8	2311.8	163.06	1.6345	1035.5	898.89	130.03	2.0523	82.525	43.456
293.00	2.0000	50202	198.44	.76690	3438.0	3665.7	247.03	.80771	2259.0	2287.3	145.94	.87622	231.39	206.80
294.00	2.0000	59881	143.49	1.3374	3440.9	3378.0	221.08	2.4891	2055.2	1965.5	199.41	3.7474	156.82	101.55
295.00	2.0000	40094	185.57	.90107	4073.7	4092.6	239.62	.49602	2926.3	2986.5	173.96	.18063	134.91	99.826
296.00	2.0000	28930	258.56	1.2169	3208.3	3152.9	232.26	.38640	1908.5	1781.1	197.41	.20023	494.38	382.22
297.00	2.0000	32634	164.66	.86547	4127.6	4199.2	186.15	.37174	3191.9	3181.8	154.66	1.1321	315.51	260.80

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
298.00	2.0000	63558	123.36	.96487	2272.6	2187.9	183.28	1.1277	1665.9	1549.1	140.41	1.5393	147.99	86.886
299.00	2.0000	95978	131.32	1.3525	1839.7	1618.6	161.38	1.9870	802.98	655.30	190.15	3.2046	72.901	20.889
300.00	2.0000	29868	175.58	.99643	3029.8	2996.1	221.49	1.1893	2129.9	1995.7	228.70	3.0328	133.49	73.003
ESTIMATE OF MEAN			159.62	1.3262	2958.2	2765.0	226.66	1.6237	1877.3	1718.0	319.10	3.7020	164.09	105.44
ESTIMATE OF STANDARD DEVIATION			61.729	1.4832	864.55	985.53	113.56	1.6986	799.81	860.55	436.91	2.6927	111.82	106.93
DEGREES OF FREEDOM			131	131	113	125	131	131	113	125	131	130	113	125
T VALUE			29.739	10.274	36.533	31.493	22.932	10.982	25.063	22.410	8.3910	15.735	15.668	11.068

55A

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 TEST 3

TABULATION OF CHC PARAMETER DETERIORATION DATA (-C. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	[redacted] D3	NOXP D3
151.00	3.0000	38047	92.327	.29424	2864.9	2881.4	109.58	.35713	1449.5	1453.0	290.31	5.8543	123.47	86.308
153.00	3.0000	70542	176.89	.81960	2667.2	2577.2	249.13	1.4303	1507.7	1409.8	383.88	5.0613	64.669	14.501
154.00	3.0000	58059	169.93	2.8375	1005.8	940.68	156.57	2.6871	305.31	249.14	172.90	4.5015	56.617	21.546
155.00	3.0030	84729	172.90	1.9608	1842.3	1723.1	241.68	2.6102	726.13	608.64	184.81	3.7848	107.38	71.494
156.00	3.0000	19522	198.23	.48071	4543.1	4337.2	207.19	.20495	2910.8	2815.3	195.24	1.8141	412.57	352.10
157.00	3.0000	41880	138.70	.15441	4020.1	4115.2	198.93	.12327	3402.6	3373.0	178.30	1.9749	172.06	123.75
159.00	3.5000	27990	153.27	1.2550	2819.7	2784.7	136.71	.72889	1489.2	1430.3	115.70	2.7543	208.52	185.05
160.00	3.0000	77841	184.81	.86749	2696.8	2653.0	271.83	1.6024	1422.5	1355.2	231.16	2.4596	75.338	57.527
161.00	3.0000	6282.0	123.19	1.3217	3246.1	3171.0	173.79	.71208	2356.5	2256.5	256.54	6.9157	93.301	49.576
162.00	3.0000	26976	128.61	.10997	4054.0	4058.5	186.97	.10997	3429.8	3443.5	182.56	2.0239	196.45	154.37
163.00	3.0000	89103	183.72	1.9960	1367.8	1308.0	237.18	2.4340	763.03	709.77	237.18	2.6654	90.551	56.643
166.00	3.0000	95338	262.01	4.4325	1503.2	1438.6	490.50	7.7724	466.71	374.87	658.52	9.9007	89.475	28.683
168.00	3.0000	50647	230.99	3.9531	1550.3	1457.3	247.61	3.1477	1047.0	956.57	261.25	7.3271	85.515	50.350
169.00	3.0000	19702	108.15	.65769	3394.9	3300.2	137.72	.73821	2064.7	1964.1	115.53	1.3713	93.552	64.871
173.00	3.0000	51713	110.26	1.8713	1640.7	1547.8	122.14	1.5648	1216.5	1144.8	99.879	.76930	98.906	93.107
174.00	3.0000	36643	191.77	2.5280	2417.7	2379.7	416.72	6.6651	357.33	283.58	2013.0	4.2247	73.098	14.331
175.00	3.0000	60533	147.19	.56424	2976.8	3021.0	269.37	.54040	2808.1	2850.1	257.45	3.8271	151.50	114.80
176.00	3.0000	77341	93.957	.33307	5133.9	5049.7	154.78	.29326	4174.3	4198.2	122.82	.14210	212.48	188.56
177.00	3.0000	88232	121.62	2.3220	4618.8	2620.7	102.81	2.4987	1152.3	1093.5	158.02	2.5973	67.599	29.423
178.00	3.0000	13546	111.72	.36328	3521.4	3598.1	184.80	.94288	1540.4	1505.9	205.48	3.1291	118.39	85.744
179.00	3.0000	44489	134.69	.13763	3634.2	3775.0	219.85	.17112	2739.8	2877.8	118.72	9.32466E-02	142.56	103.28
181.00	3.0000	1.05652E+05	132.90	1.5344	1443.9	1381.5	159.36	3.1110	306.61	252.15	191.91	3.8300	98.244	58.065
182.00	3.0000	27210	201.04	.63268	3636.6	3632.3	320.93	1.9335	1988.5	1944.2	259.09	4.6652	134.74	78.723
183.00	3.0000	50871	184.11	.42162	2838.0	2989.3	310.12	1.3640	1692.8	1751.3	282.82	4.0327	75.539	86.194
185.00	3.0000	-0.	154.53	.90983	3941.0	3849.3	230.58	2.3699	1823.2	1708.9	195.15	3.5396	270.97	99.210
186.00	3.0000	83715	77.369	.55446	2937.6	2936.9	87.496	.99025	1023.8	976.57	58.622	.46626	61.997	36.223
187.00	3.0000	25014	104.91	.13732	4244.8	4137.5	192.99	.17634	3561.4	3546.8	402.32	5.1890	136.19	92.267
190.00	3.0000	63210	121.12	1.5600	1932.4	1904.1	170.49	1.2841	1545.5	1508.0	205.66	2.3761	98.636	78.116
191.00	3.0000	61696	131.54	1.3272	1770.1	1793.4	141.89	.96919	1215.0	1224.0	153.75	1.3572	160.63	116.99
194.00	3.0000	62433	198.28	2.4750	2262.1	2223.4	268.87	3.8300	522.92	427.66	1864.0	12.254	98.679	21.379
196.00	3.0000	30926	261.65	1.5477	2908.1	2795.2	276.86	.85279	2582.7	2511.8	208.70	.24833	281.52	219.19
197.00	3.0000	91097	279.46	4.6375	1364.5	1320.6	473.28	6.1793	607.43	568.49	295.87	2.2096	129.72	113.03
200.00	3.0000	60049	189.90	1.3673	3140.9	3109.2	231.23	1.0995	1301.8	1224.0	260.98	4.1672	110.39	49.766
204.00	3.0000	60161	200.92	1.0136	3333.7	3468.5	260.00	2.1685	1598.2	1639.1	222.99	4.7709	121.58	71.587
205.00	3.0000	40327	185.74	3.1893	2190.4	2034.1	284.59	4.4971	1190.4	1000.2	811.46	7.8642	213.50	21.407
206.00	3.0000	26914	96.684	1.5763	1730.9	1703.3	133.16	1.3894	1216.6	1195.2	111.25	2.0520	78.682	56.429
207.00	3.0000	50627	238.13	1.2696	2106.1	2004.0	255.84	2.1926	777.05	697.92	241.07	1.4461	174.02	114.35
208.00	3.0000	64967	167.94	.38250	3113.3	3320.5	202.10	.33121	1861.0	1927.8	138.40	1.9511	209.76	179.40
209.00	3.0000	62566	921.63	5.3547	443.41	387.26	1022.9	2.8137	685.63	634.21	2257.0	.45856	240.78	163.41
211.00	3.0000	68202	198.48	2.9910	2282.6	2306.9	254.72	2.3615	1887.2	1909.4	465.05	8.3167	87.222	57.005
213.00	3.0000	42270	88.105	.13119	2438.3	2314.8	180.84	.85185	1737.8	1581.9	310.97	2.2825	254.65	91.568
214.00	3.0000	31279	215.36	.57414	4630.2	4268.8	309.44	1.5087	2858.1	2643.9	295.91	5.2556	290.79	105.20
216.00	3.0000	46885	197.64	1.7631	2955.6	3042.7	202.10	.52539	2743.5	2797.1	202.10	.76524	301.52	249.46
217.00	3.0000	26777	181.29	.25578	4193.2	4356.5	246.96	.14241	3463.2	3605.9	157.58	1.1156	254.05	198.66
218.00	3.0000	59545	132.56	1.1360	2252.8	2270.0	152.99	.72225	1557.2	1557.9	132.56	2.3245	115.45	42.833
220.00	3.0000	21907	161.53	.70455	3379.1	3447.6	205.94	1.2116	1906.7	1906.0	216.35	2.4596	247.72	170.47
221.00	3.0000	53693	64.961	1.0112	1678.8	1670.8	117.44	1.2034	1076.1	1025.0	164.48	1.0464	140.62	106.54
223.00	3.0000	46492	115.45	.52228	2661.8	2693.2	222.78	1.1551	1907.4	2039.6	205.00	3.4458	263.17	107.51
225.00	3.0000	58482	135.24	.25491	3282.7	3237.9	246.58	1.6402	1504.6	1339.9	299.25	7.0419	232.49	50.958
227.00	3.0000	53216	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
228.00	3.0000	39651	115.10	1.4848	3371.4	3459.2	173.49	1.4105	2725.5	2795.5	309.99	6.6781	115.53	72.737
229.00	3.0000	20501	181.94	2.2611	2514.6	2515.0	150.98	1.0737	1299.1	1165.9	111.42	2.7642	319.76	199.96
231.00	3.0000	35019	87.168	1.3492	1549.1	1569.6	131.23	.77194	1416.4	1427.8	220.34	6.3692	126.60	77.524
235.00	3.0000	25120	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
236.00	3.0000	24004	181.38	.99196	3025.3	3290.0	174.02	.13570	2427.6	2556.2	213.88	2.0386	203.28	157.17
238.00	3.0000	45951	190.20	3.5136	2025.7	1829.7	220.00	2.7751	1955.8	1769.5	182.77	3.8917	226.86	42.614
239.00	3.0000	-0.	204.46	1.9355	2123.1	2128.1	200.00	1.2261	1272.7	1230.6	72.222	1.8022	56.015	28.608
240.00	3.0000	52171	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
241.00	3.0000	44898	79.979	.63037	1417.7	1381.5	100.14	.46611	699.70	645.43	305.59	6.5329	136.39	79.773
242.00	3.0000	72714	170.38	2.1012	2294.7	2354.7	249.19	3.2093	761.99	733.64	99.896	2.7092	53.121	28.498
245.00	3.0000	40265	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
247.00	3.0000	-0.	130.04	.31735	2780.4	2875.0	240.60	2.5007	1134.1	1039.6	353.24	2.3910	338.57	209.27

56

TABLE 1

SUMMARY OF TEST DATA

TRW SYSTEMS
FLEET 2 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
ESTIMATE OF MEAN			170.93	1.4324	2684.7	2667.9	229.62	1.7293	1675.3	1635.6	326.19	3.5396	158.47	97.898
ESTIMATE OF STANDARD DEVIATION			111.73	1.2181	980.87	994.05	133.69	1.5920	909.47	940.73	425.80	2.5377	84.125	67.419
DEGREES OF FREEDOM			57	57	57	57	57	57	57	57	57	57	57	57
T VALUE			11.651	8.9551	20.845	20.440	13.100	8.2294	14.028	13.241	5.8341	10.623	14.346	11.059

57

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
301.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	1666.0	8.0000
302.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	1255.0	8.0000
303.00	71.000	3.0000	4314.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	108.00	8.0000
304.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	41.000	8.0000
305.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	59.000	8.0000
306.00	71.000	9.0000	3560.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	58.000	8.0000
307.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	47.000	8.0000
308.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	93.000	8.0000
309.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	66.000	8.0000
310.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	43.000	8.0000
311.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	69.000	8.0000
312.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	47.000	8.0000
313.00	71.000	9.0000	3680.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	952.00	8.0000
314.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	1804.0	8.0000
315.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	5990.0	8.0000
316.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	2218.0	8.0000
317.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	2347.0	8.0000
318.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	4.0000	4.0000	1576.0	8.0000
319.00	71.000	3.0000	3738.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	3472.0	8.0000
320.00	71.000	3.0000	4314.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	769.00	8.0000
321.00	71.000	3.0000	4314.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	3018.0	8.0000
322.00	71.000	3.0000	3886.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	10571	8.0000
323.00	71.000	7.0000	3760.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	1216.0	8.0000
324.00	71.000	13.000	2540.0	108.00	113.00	7.0000	2.0000	1.0000	3.0000	4.0000	5009.0	4.0000
325.00	71.000	7.0000	5005.0	220.00	318.00	2.0000	2.0000	1.0000	4.0000	4.0000	6722.0	8.0000
326.00	71.000	1.0000	4697.0	315.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	2186.0	8.0000
327.00	71.000	1.0000	4857.0	315.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	6206.0	8.0000
328.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	2650.0	8.0000
329.00	71.000	3.0000	4100.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	4756.0	8.0000
330.00	71.000	9.0000	4404.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	4288.0	8.0000
331.00	71.000	3.0000	3886.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	5201.0	8.0000
332.00	71.000	9.0000	2315.0	100.00	122.00	3.0000	2.0000	0.	4.0000	4.0000	6555.0	4.0000
333.00	71.000	9.0000	3680.0	240.00	351.00	3.0000	2.0000	1.0000	4.0000	4.0000	28085	8.0000
334.00	71.000	3.0000	2586.0	110.00	140.00	6.0000	2.0000	0.	3.0000	4.0000	4465.0	4.0000
335.00	71.000	9.0000	3100.0	210.00	302.00	3.0000	2.0000	1.0000	4.0000	4.0000	2981.0	8.0000
336.00	71.000	1.0000	2083.0	75.000	115.00	4.0000	2.0000	1.0000	3.0000	4.0000	1823.0	4.0000
337.00	71.000	12.000	2108.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	6498.0	4.0000
338.00	71.000	12.000	2108.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	5537.0	4.0000
339.00	71.000	12.000	2108.0	60.000	98.000	4.0000	1.0000	0.	3.0000	3.0000	12702	4.0000
340.00	71.000	1.0000	2108.0	75.000	115.80	4.0000	2.0000	1.0000	3.0000	4.0000	4258.0	4.0000
341.00	71.000	1.0000	4507.0	315.00	455.00	7.0000	4.0000	1.0000	3.0000	4.0000	4528.0	8.0000
342.00	71.000	4.0000	3898.0	260.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	6092.0	8.0000
343.00	71.000	3.0000	2586.0	90.000	140.00	6.0000	1.0000	1.0000	3.0000	4.0000	2582.0	4.0000
344.00	71.000	9.0000	4404.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	27733	8.0000
345.00	71.000	7.0000	4050.0	300.00	383.00	1.0000	4.0000	1.0000	3.0000	4.0000	11116	8.0000
346.00	71.000	10.000	4945.0	360.00	429.00	3.0000	4.0000	1.0000	3.0000	4.0000	6930.0	8.0000
347.00	71.000	3.0000	4313.0	250.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	2449.0	8.0000
348.00	71.000	5.0000	4473.0	265.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	6209.0	8.0000
349.00	71.000	7.0000	4095.0	335.00	440.00	2.0000	4.0000	1.0000	3.0000	4.0000	7543.0	8.0000
350.00	71.000	8.0000	3750.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	6757.0	8.0000
351.00	71.000	4.0000	3895.0	240.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	8568.0	8.0000
352.00	71.000	9.0000	4180.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	7377.0	8.0000
353.00	71.000	11.000	3904.0	285.00	360.00	7.0000	4.0000	1.0000	3.0000	4.0000	8175.0	8.0000
354.00	71.000	5.0000	3950.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	13349	8.0000
355.00	71.000	6.0000	4540.0	275.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	5912.0	8.0000
356.00	71.000	3.0000	3886.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	5079.0	8.0000
357.00	71.000	7.0000	2125.0	100.00	98.000	4.0000	1.0000	1.0000	3.0000	4.0000	3776.0	4.0000
358.00	71.000	12.000	2108.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	7796.0	4.0000
359.00	71.000	9.0000	3488.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	13811	8.0000
360.00	71.000	1.0000	3985.0	260.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	13611	8.0000
361.00	71.000	13.000	2505.0	96.000	97.000	7.0000	2.0000	0.	2.0000	4.0000	2458.0	4.0000
362.00	71.000	3.0000	3492.0	145.00	250.00	6.0000	1.0000	1.0000	3.0000	4.0000	11747	6.0000
363.00	71.000	9.0000	2315.0	100.00	122.00	7.0000	2.0000	1.0000	3.0000	4.0000	3597.0	4.0000
364.00	71.000	7.0000	4600.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	4507.0	8.0000
365.00	71.000	8.0000	3750.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	4198.0	8.0000
366.00	71.000	3.0000	3510.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	6716.0	8.0000

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 19

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
367.00	71.000	5.0000	4200.0	255.00	360.00	1.0000	2.0000	1.0000	3.0000	4.0000	4179.0	8.0000
368.00	71.000	8.0000	3220.0	125.00	198.00	2.0000	1.0000	0.	3.0000	4.0000	5992.0	6.0000
369.00	71.000	10.000	3185.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	5047.0	8.0000
370.00	71.000	5.0000	3203.0	200.00	307.00	6.0000	2.0000	0.	3.0000	4.0000	2358.0	8.0000
371.00	71.000	1.0000	3960.0	260.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	8510.0	8.0000
372.00	71.000	3.0000	3685.0	255.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	590.00	8.0000
373.00	71.000	5.0000	4050.0	255.00	350.00	1.0000	2.0000	1.0000	3.0000	4.0000	3601.0	8.0000
374.00	71.000	4.0000	3990.0	260.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	6782.0	8.0000
375.00	71.000	9.0000	2315.0	75.000	98.000	7.0000	1.0000	0.	3.0000	4.0000	4082.0	4.0000
376.00	71.000	3.0000	2502.0	90.000	140.00	6.0000	1.0000	0.	3.0000	4.0000	12635	4.0000
377.00	71.000	13.000	2600.0	150.00	146.00	7.0000	1.0000	0.	3.0000	4.0000	3194.0	6.0000
378.00	71.000	9.0000	2315.0	100.00	122.00	3.0000	2.0000	0.	3.0000	4.0000	12857	4.0000
379.00	71.000	7.0000	2189.0	100.00	98.000	4.0000	2.0000	0.	3.0000	4.0000	12977	4.0000
380.00	71.000	9.0000	2315.0	100.00	122.00	3.0000	2.0000	1.0000	3.0000	4.0000	10722	4.0000
381.00	71.000	9.0000	2315.0	100.00	122.00	3.0000	2.0000	0.	3.0000	4.0000	7816.0	4.0000
382.00	71.000	10.000	2917.0	115.00	200.00	2.0000	1.0000	1.0000	3.0000	4.0000	11302	6.0000
383.00	71.000	5.0000	4755.0	325.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	7005.0	8.0000
384.00	71.000	6.0000	4540.0	255.00	360.00	1.0000	2.0000	1.0000	3.0000	4.0000	10614	8.0000
385.00	71.000	7.0000	3285.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	3054.0	6.0000
386.00	71.000	3.0000	4945.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	7066.0	8.0000
387.00	71.000	7.0000	3255.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	3041.0	6.0000
388.00	71.000	8.0000	2100.0	57.000	91.000	5.0000	1.0000	0.	3.0000	4.0000	11615	4.0000
389.00	71.000	9.0000	2924.0	115.00	200.00	2.0000	1.0000	0.	3.0000	4.0000	6948.0	6.0000
390.00	71.000	4.0000	4770.0	320.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	6005.0	8.0000
391.00	71.000	5.0000	5156.0	325.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	6593.0	8.0000
392.00	71.000	9.0000	3019.0	145.00	250.00	2.0000	1.0000	1.0000	3.0000	4.0000	11649	6.0000
393.00	71.000	3.0000	4214.0	300.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	4961.0	8.0000
394.00	71.000	3.0000	3610.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	4804.0	8.0000
395.00	71.000	9.0000	4183.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	8744.0	8.0000
396.00	71.000	3.0000	3492.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	12272	8.0000
397.00	71.000	8.0000	4200.0	255.00	350.00	1.0000	2.0000	1.0000	3.0000	4.0000	12619	8.0000
398.00	71.000	5.0000	4275.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	12962	8.0000
399.00	71.000	3.0000	4314.0	300.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	6397.0	8.0000
400.00	71.000	2.0000	5143.0	345.00	472.00	6.0000	4.0000	1.0000	3.0000	4.0000	5214.0	8.0000
401.00	71.000	1.0000	3986.0	260.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	6316.0	8.0000
402.00	71.000	9.0000	4067.0	260.00	400.00	3.0000	2.0000	1.0000	2.0000	4.0000	4382.0	8.0000
403.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	6275.0	8.0000
404.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	4.0000	1.0000	3.0000	4.0000	16061	8.0000
405.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	13775	8.0000
406.00	71.000	10.000	4767.0	320.00	429.00	3.0000	4.0000	1.0000	3.0000	4.0000	2507.0	8.0000
407.00	71.000	7.0000	4050.0	300.00	383.00	1.0000	4.0000	0.	3.0000	4.0000	9288.0	8.0000
408.00	71.000	5.0000	4265.0	300.00	400.00	6.0000	4.0000	1.0000	2.0000	4.0000	6467.0	8.0000
409.00	71.000	4.0000	4770.0	370.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	10528	8.0000
410.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	32322	8.0000
411.00	71.000	9.0000	4404.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	22543	8.0000
412.00	71.000	4.0000	5267.0	320.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	6467.0	8.0000
413.00	71.000	3.0000	4446.0	255.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	14918	8.0000
414.00	71.000	3.0000	4314.0	255.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	15693	8.0000
415.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	8400.0	8.0000
416.00	71.000	5.0000	3795.0	300.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	7218.0	8.0000
417.00	71.000	5.0000	5155.0	260.00	455.00	6.0000	2.0000	1.0000	3.0000	4.0000	4510.0	8.0000
418.00	71.000	9.0000	4404.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	31638	8.0000
419.00	71.000	8.0000	4200.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	14661	8.0000
420.00	71.000	1.0000	4697.0	315.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	4460.0	8.0000
421.00	71.000	10.000	4461.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	6554.0	8.0000
422.00	71.000	4.0000	5267.0	280.00	455.00	6.0000	2.0000	1.0000	3.0000	4.0000	9614.0	8.0000
423.00	71.000	9.0000	4726.0	260.00	400.00	3.0000	2.0000	1.0000	3.0000	4.0000	22127	8.0000
424.00	71.000	3.0000	4140.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	3172.0	8.0000
425.00	71.000	5.0000	4755.0	325.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	1677.0	8.0000
426.00	71.000	3.0000	3736.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	6961.0	8.0000
427.00	71.000	3.0000	3730.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	10391	8.0000
428.00	71.000	9.0000	4945.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	11486	8.0000
429.00	71.000	6.0000	4755.0	335.00	440.00	2.0000	4.0000	1.0000	3.0000	4.0000	12923	8.0000
430.00	71.000	5.0000	3950.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	28497	8.0000
431.00	71.000	3.0000	3885.0	270.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	5720.0	8.0000
432.00	71.000	1.0000	3980.0	260.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	11688	8.0000

59

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1B

TABULATION OF CHC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
433.00	71.000	8.0000	3230.0	145.00	225.00	1.0000	1.0000	0.	3.0000	4.0000	13128	6.0000
434.00	71.000	9.0000	3660.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	7624.0	8.0000
435.00	71.000	8.0000	3230.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	11979	6.0000
436.00	71.000	2.0000	5143.0	345.00	472.00	6.0000	4.0000	1.0000	2.0000	4.0000	4670.0	8.0000
437.00	71.000	8.0000	4275.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	6730.0	6.0000
438.00	71.000	12.000	3253.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	15918	4.0000
439.00	71.000	8.0000	3750.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	8894.0	8.0000
440.00	71.000	10.000	3607.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	24942	8.0000
441.00	71.000	12.000	2562.0	65.000	97.000	7.0000	0.	0.	3.0000	3.0000	14206	4.0000
442.00	71.000	6.0000	4995.0	300.00	383.00	2.0000	4.0000	1.0000	3.0000	4.0000	16787	8.0000
443.00	71.000	8.0000	4995.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	13774	8.0000
444.00	71.000	12.000	2108.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	15506	4.0000
445.00	71.000	13.000	1865.0	73.000	71.000	7.0000	2.0000	0.	3.0000	4.0000	5369.0	4.0000
446.00	71.000	13.000	2350.0	69.000	73.000	7.0000	2.0000	0.	3.0000	4.0000	5773.0	4.0000
447.00	71.000	13.000	1865.0	102.00	97.000	7.0000	2.0000	0.	3.0000	4.0000	7206.0	4.0000
448.00	71.000	13.000	2350.0	96.000	97.000	7.0000	2.0000	1.0000	2.0000	4.0000	9261.0	4.0000
449.00	71.000	12.000	2108.0	60.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	27162	4.0000
450.00	71.000	13.000	2535.0	108.00	113.00	7.0000	2.0000	1.0000	3.0000	4.0000	7007.0	4.0000
ESTIMATE OF MEAN			3747.4	216.13	305.55	4.3600	2.3200	.82667	3.0133	3.9467	8059.3	7.1067
ESTIMATE OF STANDARD DEVIATION			883.33	81.021	114.42	1.8941	1.0188	.37480	.23133	.22545	6451.3	1.5807
DEGREES OF FREEDOM			149	149	149	149	149	149	149	149	149	149
T VALUE			51.958	32.671	32.705	28.192	27.891	26.657	159.54	214.40	15.300	55.063

60

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
301.00	1.1000	3.0000	4.8500	47.250	8.8300	-0.	3.0800	8.9300	7.0800	-0.	3.2000	14.450	8.1000	-0.
302.00	1.1000	3.0000	2.4100	25.240	3.9100	-0.	1.3400	5.9500	2.8600	-0.	1.9000	31.750	3.7400	-0.
303.00	1.1000	3.0000	3.4700	59.950	4.8400	-0.	1.7700	21.920	5.3200	-0.	2.5300	48.630	3.3600	-0.
304.00	1.1000	9.0000	4.4600	39.990	6.1300	-0.	2.5200	12.580	4.8800	-0.	3.6300	12.210	6.5700	-0.
305.00	1.1000	9.0000	4.5100	40.020	6.4400	-0.	2.9900	34.870	5.3300	-0.	3.9900	33.550	6.9500	-0.
306.00	1.1000	9.0000	4.3700	36.770	6.7700	-0.	3.2300	12.620	5.4000	-0.	4.3200	15.300	7.4300	-0.
307.00	1.1000	9.0000	4.9100	42.140	6.7900	-0.	3.0900	18.910	4.0600	-0.	4.2700	18.350	6.9900	-0.
308.00	1.1000	9.0000	5.7300	46.920	7.4400	-0.	3.2400	18.940	4.4800	-0.	4.5500	18.380	7.4300	-0.
309.00	1.1000	9.0000	4.9200	43.310	6.7500	-0.	3.0900	15.760	4.5100	-0.	4.3600	18.350	6.9100	-0.
310.00	1.1000	9.0000	5.5600	46.740	10.210	-0.	3.5600	18.920	6.1500	-0.	4.6400	21.420	8.8300	-0.
311.00	1.1000	9.0000	4.8700	26.740	8.5700	-0.	3.0900	12.580	4.7900	-0.	4.0800	18.320	7.7900	-0.
312.00	1.1000	9.0000	4.9800	39.990	7.3900	-0.	3.3900	15.730	4.7300	-0.	4.8800	15.260	8.0600	-0.
313.00	1.1000	9.0000	4.3800	49.940	6.4100	-0.	2.2700	12.590	4.2100	-0.	3.6300	15.460	7.9700	-0.
314.00	1.1000	3.0000	3.9600	34.930	5.9700	-0.	1.8200	11.920	3.1500	-0.	2.2300	20.240	4.1500	-0.
315.00	1.1000	3.0000	2.6100	22.050	5.5100	-0.	1.7600	11.890	4.1900	-0.	2.0500	20.180	5.2900	-0.
316.00	1.1000	3.0000	3.1700	31.510	3.9900	-0.	1.9800	8.9400	3.1600	-0.	2.2700	20.240	3.8000	-0.
317.00	1.1000	3.0000	2.7200	25.170	5.0800	-0.	1.7400	8.9100	3.3900	-0.	1.9900	11.520	4.6600	-0.
318.00	1.1000	3.0000	2.3100	28.430	4.6900	-0.	1.3800	11.860	3.3300	-0.	1.7600	25.900	4.2200	-0.
319.00	1.1000	3.0000	4.0100	37.290	4.1300	-0.	2.6200	20.640	3.2000	-0.	2.8800	31.470	4.1100	-0.
320.00	1.1000	3.0000	3.8700	69.250	6.2900	-0.	2.0000	15.640	4.9800	-0.	2.8000	48.580	5.0700	-0.
321.00	1.1000	3.0000	4.7700	53.360	9.3900	-0.	3.3700	34.550	6.1600	-0.	3.1800	36.580	7.5900	-0.
322.00	1.1000	3.0000	4.9600	66.670	6.7500	-0.	3.4400	47.000	3.7500	-0.	3.4300	42.570	6.5300	-0.
323.00	1.1000	7.0000	3.3200	53.000	6.9500	-0.	1.6500	21.980	5.7100	-0.	2.4600	33.520	7.0100	-0.
324.00	1.1000	13.000	3.1100	43.250	8.0100	-0.	2.1000	25.070	4.9400	-0.	2.0800	27.370	5.0100	-0.
325.00	1.1000	7.0000	5.0500	90.360	6.7700	-0.	4.4300	63.040	4.7100	-0.	6.3900	55.060	7.2300	-0.
326.00	1.1000	1.0000	2.6500	29.770	7.0900	-0.	2.3800	15.750	7.1800	-0.	3.5400	15.250	11.390	-0.
327.00	1.1000	1.0000	2.7600	29.700	6.6900	-0.	2.2400	6.2700	4.0700	-0.	3.2200	9.1200	6.5000	-0.
328.00	1.1000	9.0000	3.0500	39.660	8.9900	-0.	1.7100	15.580	5.2500	-0.	2.6500	18.150	8.1800	-0.
329.00	1.1000	3.0000	4.1200	52.470	6.2600	-0.	2.7900	21.710	6.2600	-0.	3.0700	24.080	6.4500	-0.
330.00	1.1000	9.0000	2.8600	27.480	9.5100	-0.	1.8200	14.610	5.9300	-0.	1.6000	8.5100	6.4500	-0.
331.00	1.1000	3.0000	4.5800	46.880	6.8800	-0.	2.5100	18.780	4.7300	-0.	2.8000	21.270	7.0700	-0.
332.00	1.1000	9.0000	3.8600	47.350	4.4200	-0.	2.3200	29.860	2.7500	-0.	2.4200	31.880	4.2700	-0.
333.00	1.1000	9.0000	2.8000	63.490	5.1000	-0.	1.8800	20.860	3.6700	-0.	3.5400	20.240	5.1600	-0.
334.00	1.1000	3.0000	3.4200	47.470	4.1100	-0.	4.1100	20.840	4.2700	-0.	1.4500	14.450	4.0000	-0.
335.00	1.1000	9.0000	2.0600	43.960	2.9100	-0.	2.0000	20.810	3.1300	-0.	3.1800	23.080	4.3800	-0.
336.00	1.1000	1.0000	2.3700	53.400	4.7000	-0.	1.7200	35.680	3.1000	-0.	1.9700	40.400	4.6000	-0.
337.00	1.1000	12.000	6.3900	59.660	4.6900	-0.	4.3600	26.650	3.8600	-0.	5.7200	45.970	3.8400	-0.
338.00	1.1000	12.000	6.0100	101.96	4.6600	-0.	3.8700	65.180	4.4400	-0.	6.7900	97.760	2.9600	-0.
339.00	1.1000	12.000	9.1500	85.220	5.2800	-0.	5.3300	41.510	4.6500	-0.	7.3100	60.420	4.6600	-0.
340.00	1.1000	1.0000	3.2800	[illegible]2.650	13.160	-0.	1.8500	26.700	7.0400	-0.	2.9900	43.190	8.4000	-0.
341.00	1.1000	1.0000	4.7900	69.450	7.0700	-0.	2.7400	20.730	6.3300	-0.	4.3200	25.870	7.6300	-0.
342.00	1.1000	4.0000	3.4900	40.910	7.4900	-0.	1.9600	26.640	5.9700	-0.	1.9500	25.850	6.6300	-0.
343.00	1.1000	3.0000	1.9600	47.040	4.3700	-0.	1.1400	20.700	3.4000	-0.	1.4500	25.820	4.0500	-0.
344.00	1.1000	9.0000	7.0600	153.11	3.4100	-0.	3.3000	77.030	2.8500	-0.	4.8700	100.63	3.2800	-0.
345.00	1.1000	7.0000	7.7300	71.890	2.1300	-0.	7.7800	41.540	1.6600	-0.	8.1000	43.190	2.0100	-0.
346.00	1.1000	10.000	4.2400	62.550	7.2800	-0.	2.2900	29.730	4.8200	-0.	3.1800	40.400	6.9900	-0.
347.00	1.1000	3.0000	2.3400	28.240	6.5400	-0.	1.2000	11.890	4.1100	-0.	1.3400	11.530	6.3500	-0.
348.00	1.1000	5.0000	3.8400	68.730	10.410	-0.	4.1000	47.270	11.030	-0.	4.0800	45.870	11.820	-0.
349.00	1.1000	7.0000	5.9100	77.860	3.6500	-0.	5.1300	35.490	2.5700	-0.	7.6700	48.790	4.1300	-0.
350.00	1.1000	8.0000	4.9100	84.150	6.2400	-0.	3.0800	62.110	3.8000	-0.	4.1400	71.750	5.9600	-0.
351.00	1.1000	4.0000	3.1400	46.770	5.9500	-0.	3.4700	35.530	5.3700	-0.	4.1300	45.970	6.9900	-0.
352.00	1.1000	9.0000	3.9500	74.890	8.1400	-0.	3.4100	56.190	5.0800	-0.	4.7900	60.270	7.7200	-0.
353.00	1.1000	11.000	4.5200	62.030	4.0500	-0.	2.8000	32.430	3.4400	-0.	5.1900	40.050	4.2300	-0.
354.00	1.1000	5.0000	5.3100	49.570	7.7000	-0.	3.1900	23.530	5.2400	-0.	3.1700	22.840	7.1400	-0.
355.00	1.1000	6.0000	6.5000	112.58	6.5200	-0.	4.8100	85.460	4.2200	-0.	6.9600	97.240	6.7200	-0.
356.00	1.1000	3.0000	2.4700	40.440	5.1400	-0.	1.0200	14.720	2.9700	-0.	1.3300	20.000	4.8200	-0.
357.00	1.1000	7.0000	2.5800	47.050	4.3000	-0.	1.3500	23.620	2.9500	-0.	1.5700	31.520	3.5600	-0.
358.00	1.1000	12.000	7.9200	89.680	3.0000	-0.	3.5800	64.370	2.1300	-0.	6.1300	73.820	2.5400	-0.
359.00	1.1000	9.0000	4.8200	61.660	7.0600	-0.	2.4000	29.300	3.5400	-0.	3.0100	28.430	6.8300	-0.
360.00	1.1000	1.0000	7.1500	110.07	5.7700	-0.	6.1400	78.390	3.8200	-0.	8.6000	78.900	6.6900	-0.
361.00	1.1000	13.000	2.6800	18.220	9.2000	-0.	1.7700	8.7300	6.2700	-0.	1.9300	11.300	6.4800	-0.
362.00	1.1000	3.0000	2.1700	45.120	4.3400	-0.	.73000	11.590	3.3800	-0.	2.0700	14.060	5.2400	-0.
363.00	1.1000	9.0000	4.8800	47.830	4.0400	-0.	2.6400	32.590	3.0300	-0.	3.4600	69.010	2.6400	-0.
364.00	1.1000	7.0000	5.8100	76.290	5.1800	-0.	3.0000	29.660	5.0900	-0.	6.2600	43.170	5.7200	-0.
365.00	1.1000	8.0000	3.9100	53.160	9.4400	-0.	1.8900	29.570	4.0300	-0.	2.5300	28.700	6.7100	-0.
366.00	1.1000	3.0000	2.7500	11.200	4.6800	-0.	1.3700	11.860	3.2500	-0.	1.8000	14.380	4.5300	-0.

61

TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETE- DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
367.00	1.1000	8.0000	3.7100	78.060	8.1100	-0.	2.7500	66.220	5.4600	-0.	3.5500	71.960	8.7500	-0.
368.00	1.1000	6.0000	4.7800	52.680	7.0500	-0.	2.5800	41.550	4.2900	-0.	4.2600	51.850	5.1400	-0.
369.00	1.1000	10.000	7.6500	196.68	2.2200	-0.	4.6500	130.50	2.1400	-0.	5.3300	143.92	2.4000	-0.
370.00	1.1000	5.0000	4.0600	53.430	4.3400	-0.	2.6900	35.600	3.4300	-0.	2.9400	46.070	3.9300	-0.
371.00	1.1000	1.0000	2.3900	50.140	3.7400	-0.	2.3100	35.670	3.6900	-0.	3.1500	40.380	4.8800	-0.
372.00	1.1000	3.0000	2.4500	31.250	10.030	-0.	1.4900	14.820	8.1800	-0.	2.0400	25.890	10.110	-0.
373.00	1.1000	8.0000	3.4100	81.370	6.1800	-0.	2.1400	53.440	4.1300	-0.	2.3700	60.510	5.9800	-0.
374.00	1.1000	4.0000	3.7300	34.950	10.540	-0.	2.0700	11.860	7.5900	-0.	2.5200	11.510	9.3800	-0.
375.00	1.1000	9.0000	2.0200	37.540	2.8900	-0.	3.1000	65.300	2.4500	-0.	3.8300	69.130	2.9900	-0.
376.00	1.1000	3.0000	3.2700	34.430	6.9700	-0.	2.1200	20.750	4.7800	-0.	3.1700	23.010	5.3800	-0.
377.00	1.1000	13.000	3.9600	37.550	6.1100	-0.	2.2900	20.700	5.0400	-0.	2.5700	20.090	5.2500	-0.
378.00	1.1000	9.0000	3.3600	50.300	5.4500	-0.	2.1600	29.680	4.1500	-0.	2.4800	48.970	4.4100	-0.
379.00	1.1000	7.0000	3.0500	34.440	3.2900	-0.	1.6100	17.800	3.2100	-0.	2.1600	25.900	3.1900	-0.
380.00	1.1000	3.0000	4.2900	62.560	5.7100	-0.	3.3200	59.400	3.2200	-0.	3.4400	63.410	4.0600	-0.
381.00	1.1000	9.0000	3.0500	43.630	5.0300	-0.	1.9200	32.510	3.8500	-0.	2.2500	37.290	4.6700	-0.
382.00	1.1000	10.000	2.9000	28.210	6.6600	-0.	1.7300	14.840	4.5400	-0.	1.9300	14.400	6.4800	-0.
383.00	1.1000	5.0000	3.4700	65.700	6.9600	-0.	1.7000	8.8700	6.2300	-0.	1.9900	14.350	8.1900	-0.
384.00	1.1000	6.0000	3.5400	53.110	9.0000	-0.	2.4300	29.660	9.3700	-0.	2.8100	34.560	8.7800	-0.
385.00	1.1000	7.0000	3.3800	103.25	4.7900	-0.	2.1300	59.360	3.3400	-0.	3.4200	86.410	3.7800	-0.
386.00	1.1000	3.0000	4.4400	34.570	7.7600	-0.	1.7600	14.900	5.8300	-0.	2.0900	20.110	6.8400	-0.
387.00	1.1000	7.0000	4.8600	134.08	4.0700	-0.	4.0900	82.990	4.2200	-0.	5.2100	135.19	2.9300	-0.
388.00	1.1000	8.0000	4.4100	65.620	1.8100	-0.	3.9300	71.060	1.2400	-0.	5.6100	74.700	1.2000	-0.
389.00	1.1000	9.0000	5.6600	65.450	4.3500	-0.	5.2400	53.290	3.1300	-0.	6.8000	48.850	3.9200	-0.
390.00	1.1000	4.0000	2.5400	37.520	8.4500	-0.	1.9200	23.730	7.0800	-0.	2.2900	23.030	8.0600	-0.
391.00	1.1000	5.0000	5.4500	111.67	6.4100	-0.	2.9400	25.570	7.5600	-0.	3.7500	37.250	8.7500	-0.
392.00	1.1000	9.0000	2.5800	31.030	6.5300	-0.	1.9300	20.670	4.2000	-0.	2.3800	25.800	5.6900	-0.
393.00	1.1000	3.0000	3.3200	52.850	4.4600	-0.	3.2900	58.930	3.9900	-0.	2.9200	54.320	5.3700	-0.
394.00	1.1000	3.0000	3.7700	28.150	4.8100	-0.	1.8500	11.830	3.5500	-0.	2.4400	14.350	5.7200	-0.
395.00	1.1000	9.0000	2.8400	53.060	4.7400	-0.	1.6900	15.040	5.3500	-0.	2.9600	17.740	5.3700	-0.
396.00	1.1000	3.0000	6.5100	55.680	6.7600	-0.	4.0000	20.580	4.9000	-0.	4.1800	22.820	7.0700	-0.
397.00	1.1000	8.0000	3.5000	37.010	9.3700	-0.	1.8000	18.170	6.8800	-0.	2.0000	20.190	9.6700	-0.
398.00	1.1000	8.0000	4.4600	46.180	7.1800	-0.	2.2400	11.710	5.6700	-0.	3.0200	19.880	7.1200	-0.
399.00	1.1000	3.0000	4.0200	55.300	5.3400	-0.	1.9600	15.000	3.9700	-0.	2.2600	21.410	5.6700	-0.
400.00	1.1000	2.0000	2.3000	24.510	8.3300	-0.	7.60000E-02	17.410	5.2200	-0.	1.0300	14.080	8.7900	-0.
401.00	1.1000	1.0000	3.9500	5.0400	6.0900	-0.	2.9800	45.490	4.0200	-0.	2.6000	47.780	5.4800	-0.
402.00	1.1000	9.0000	3.5300	71.460	6.5100	-0.	1.7900	36.330	4.3900	-0.	3.0000	52.880	6.0200	-0.
403.00	1.1000	9.0000	4.8200	61.960	7.0700	-0.	1.7100	15.430	5.2300	-0.	4.5400	22.020	7.2300	-0.
404.00	1.1000	9.0000	3.1400	77.310	5.6600	-0.	.84000	24.340	4.1000	-0.	1.2500	29.520	6.7400	-0.
405.00	1.1000	9.0000	4.7200	123.31	7.1500	-0.	3.2900	72.140	4.5200	-0.	4.7600	71.180	7.3800	-0.
406.00	1.1000	10.000	5.3100	41.090	7.3600	-0.	2.0400	17.520	4.9400	-0.	2.8500	18.170	8.0200	-0.
407.00	1.1000	7.0000	13.760	192.75	1.4200	-0.	7.8900	135.31	1.4300	-0.	10.400	214.26	1.2500	-0.
408.00	1.1000	5.0000	2.9000	29.130	5.2300	-0.	2.7500	8.1800	4.9100	-0.	3.4100	12.640	5.1400	-0.
409.00	1.1000	4.0000	10.230	236.07	2.4100	-0.	2.1300	32.410	4.1500	-0.	2.7700	32.630	5.6900	-0.
410.00	1.1000	9.0000	4.7600	121.24	5.0000	-0.	2.3500	57.420	4.0700	-0.	2.6800	67.460	6.0100	-0.
411.00	1.1000	9.0000	5.3300	50.550	5.9300	4.0400	3.0800	25.010	4.3600	3.3000	4.1200	30.120	5.9100	4.4000
412.00	1.1000	4.0000	2.6900	49.600	9.5900	-0.	1.4500	25.150	6.8600	-0.	2.2800	31.470	7.8500	-0.
413.00	1.1000	3.0000	6.6500	87.110	8.3000	-0.	3.9900	48.970	5.9200	-0.	4.9200	48.990	8.7300	-0.
414.00	1.1000	3.0000	5.7100	83.160	5.9900	4.1100	2.5400	16.560	4.9200	3.7500	3.1100	28.930	6.3000	4.6100
415.00	1.1000	9.0000	3.2400	60.550	7.4700	5.2100	1.6200	18.810	4.7300	3.8100	1.8200	22.080	7.7400	6.0900
416.00	1.1000	5.0000	5.6200	67.490	5.9400	4.0500	2.9700	59.410	3.7300	2.8200	4.0100	60.290	5.7700	4.3800
417.00	1.1000	5.0000	6.2000	99.570	7.1300	5.1100	3.2000	44.980	5.8700	4.9300	3.3700	46.290	6.7600	5.3300
418.00	1.1000	9.0000	4.3300	141.32	5.1200	4.1300	5.7600	99.110	3.6100	3.3300	4.8400	109.42	5.9200	4.6400
419.00	1.1000	8.0000	4.2600	59.050	5.6400	4.0400	2.8000	41.100	3.4900	2.9200	3.6300	51.330	5.3800	4.2400
420.00	1.1000	1.0000	4.1300	47.970	8.1300	6.6700	3.6500	25.140	6.0600	5.5400	4.8100	26.760	9.0300	8.2300
421.00	1.1000	10.000	4.3700	88.710	7.1500	5.7000	2.7000	42.400	5.1500	4.4400	3.5800	54.080	7.5200	6.2400
422.00	1.1000	4.0000	4.6800	79.310	6.6500	4.7400	2.3400	50.210	4.4100	3.3900	3.2300	56.650	6.4600	4.9700
423.00	1.1000	9.0000	6.0500	157.60	5.3200	-0.	3.4200	97.920	3.9300	-0.	3.6700	106.18	5.6900	-0.
424.00	1.1000	3.0000	3.7200	21.610	5.2900	-0.	2.0100	8.4700	3.7700	4.1600	2.1700	10.280	5.4600	-0.
425.00	1.1000	5.0000	5.8200	115.77	5.7600	4.5200	3.0300	16.340	5.6100	5.0000	3.6800	22.900	8.0900	6.7800
426.00	1.1000	3.0000	2.3000	16.270	4.0100	3.5400	1.5300	7.6600	2.9600	2.6200	4.6900	11.570	3.9700	3.5100
427.00	1.1000	3.0000	6.3200	39.500	4.2200	3.5900	4.8400	23.740	3.9300	2.8800	5.2600	36.160	4.2100	3.3300
428.00	1.1000	9.0000	4.7200	75.840	7.2500	5.3500	3.1600	59.260	4.6200	3.5100	4.3200	65.400	7.2200	5.6900
429.00	1.1000	6.0000	3.9700	39.460	8.3900	6.8200	2.7200	24.640	6.4400	5.0800	4.3300	36.170	8.4200	6.8300
430.00	1.1000	5.0000	8.1500	110.72	6.5400	5.2800	4.4000	79.790	5.0900	4.0000	6.0900	77.430	7.9700	6.4000
431.00	1.1000	3.0000	3.6600	79.970	4.0600	3.0100	2.1000	17.450	4.2200	3.1300	2.4800	27.740	5.3800	4.1800
432.00	1.1000	1.0000	3.8100	69.510	3.8200	2.9900	2.9900	39.720	2.7700	2.2100	4.1600	38.540	5.1800	4.4000

62

TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
433.00	1.1000	8.0000	3.3200	62.800	3.6200	3.3200	1.5300	29.730	2.6600	2.1200	3.2300	49.020	3.0600	2.6000
434.00	1.1000	9.0000	5.0100	107.50	4.1900	3.4000	2.9100	75.560	2.7700	2.5200	3.7700	87.300	4.4200	3.7500
435.00	1.1000	8.0000	6.3500	141.53	2.7400	2.0800	4.4100	118.78	2.2600	1.5400	5.1500	89.720	3.8200	2.9400
436.00	1.1000	2.0000	2.6200	65.440	6.1800	5.6500	1.1800	21.030	5.3400	5.3400	1.6600	16.910	7.2600	-0.
437.00	1.1000	8.0000	8.1500	103.65	6.8000	5.8800	2.8600	60.790	5.5600	5.2100	3.8600	72.140	7.5100	6.6300
438.00	1.1000	12.000	8.1400	104.17	3.1300	3.3300	4.3800	59.500	3.2500	2.9700	6.9800	99.440	2.9700	2.2800
439.00	1.1000	8.0000	8.5300	129.56	3.0500	-0.	2.3800	33.300	3.3400	-0.	2.6100	36.100	4.5700	-0.
440.00	1.1000	10.000	3.3600	40.730	6.7200	-0.	1.3900	9.3000	4.3500	-0.	2.5600	10.190	6.7900	-0.
441.00	1.1000	12.000	7.0400	68.280	3.2700	-0.	2.5600	29.700	3.4200	-0.	2.7900	47.160	2.8400	-0.
442.00	1.1000	6.0000	8.7100	102.89	6.8000	5.7300	5.2600	65.180	5.3300	4.7100	6.4500	75.270	7.1500	6.1900
443.00	1.1000	8.0000	5.8700	98.260	6.7700	5.5900	3.3600	60.790	4.6100	3.8800	4.9100	73.590	6.8300	5.5600
444.00	1.1000	12.000	5.5600	138.11	1.0800	.85000	2.4400	64.240	1.5500	1.2000	4.3100	69.040	1.8100	1.6300
445.00	1.1000	13.000	3.9400	26.470	4.9000	4.3800	2.9100	32.390	3.2400	3.0100	-0.	-0.	-0.	-0.
446.00	1.1000	13.000	5.1400	47.380	4.1800	2.7200	2.5700	23.740	3.9500	2.6600	3.9700	32.360	3.0800	2.2100
447.00	1.1000	13.000	3.6300	47.330	2.8300	1.6800	1.4300	23.710	2.1800	1.5600	1.5100	21.840	2.7200	1.9000
448.00	1.1000	13.000	2.9200	33.960	7.3300	4.3200	2.0600	18.680	4.1000	4.0600	2.1300	19.300	6.3300	4.5700
449.00	1.1000	12.000	3.8100	51.860	4.5100	3.0400	2.1900	27.400	6.2900	5.0900	3.1700	31.270	4.2900	3.3400
450.00	1.1000	13.000	2.3000	28.860	6.0400	3.4600	1.6400	15.320	3.9200	2.9700	1.6800	16.910	4.7200	3.3000
ESTIMATE OF MEAN			4.4437	63.419	5.9516	4.1979	2.7158	34.066	4.4637	3.5194	3.5268	40.953	5.8693	4.5532
ESTIMATE OF STANDARD DEVIATION			1.8055	36.924	2.0338	1.3730	1.2170	24.915	1.4835	1.1617	1.6179	29.934	1.9929	1.6494
DEGREES OF FREEDOM			149	149	149	32	149	149	149	33	148	148	148	30
T VALUE			30.143	21.036	35.839	17.564	27.330	16.746	36.850	17.665	26.608	16.700	35.949	15.370

63

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CHC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
301.00	1.1000	3.0000	4.4500	47.250	8.8300	-0.	3.0800	8.9300	7.0800	-0.	3.2000	14.450	8.1000	-0.
301.00	1.2000	3.0000	3.4000	37.900	5.5300	-0.	2.1200	14.920	4.2700	-0.	-0.	-0.	-0.	-0.
302.00	1.1000	3.0000	2.4100	25.240	3.9100	-0.	1.3400	5.9200	2.8900	-0.	1.9000	31.750	3.7400	-0.
302.00	1.2000	3.0000	2.9100	25.390	4.0800	-0.	1.6700	11.390	3.1300	-0.	-0.	-0.	-0.	-0.
303.00	1.1000	3.0000	3.4700	59.400	4.8400	-0.	1.7700	21.920	5.3200	-0.	2.5300	48.630	3.3600	-0.
303.00	1.2000	3.0000	3.2600	57.940	4.4300	-0.	1.7200	21.170	3.7800	-0.	-0.	-0.	-0.	-0.
304.00	1.1000	9.0000	4.4600	39.990	6.1300	-0.	2.5200	12.380	4.8800	-0.	3.6300	12.210	6.5700	-0.
304.00	1.2000	9.0000	4.9200	40.140	8.1900	-0.	2.9500	22.060	-0.	-0.	-0.	-0.	-0.	-0.
305.00	1.1000	9.0000	4.5100	40.020	6.4400	-0.	2.9900	34.870	5.3300	-0.	3.9900	33.550	6.9500	-0.
305.00	1.2000	9.0000	4.9600	53.380	6.4400	-0.	3.4600	37.780	4.2300	-0.	-0.	-0.	-0.	-0.
306.00	1.1000	9.0000	4.3700	36.770	6.7700	-0.	3.2300	12.620	5.4000	-0.	4.3200	15.300	7.4300	-0.
306.00	1.2000	9.0000	5.0600	40.280	6.4300	-0.	3.0200	22.080	5.1400	-0.	-0.	-0.	-0.	-0.
307.00	1.1000	9.0000	4.9100	42.140	6.7900	-0.	3.0900	18.910	4.0600	-0.	4.2700	18.350	6.9900	-0.
307.00	1.2000	9.0000	6.0700	50.160	7.6300	-0.	3.5600	22.030	4.8500	-0.	-0.	-0.	-0.	-0.
308.00	1.1000	9.0000	5.7300	46.920	7.4400	-0.	3.2400	16.940	4.4900	-0.	4.5500	18.380	7.4300	-0.
308.00	1.2000	9.0000	5.6800	31.010	6.6200	-0.	3.4100	15.730	7.6800	-0.	-0.	-0.	-0.	-0.
309.00	1.1000	9.0000	4.9200	43.310	6.7500	-0.	3.0900	15.760	4.5100	-0.	4.3600	18.350	6.9100	-0.
309.00	1.2000	9.0000	5.2700	33.340	6.7400	-0.	3.0100	15.720	4.0200	-0.	-0.	-0.	-0.	-0.
310.00	1.1000	9.0000	5.5600	46.740	10.210	-0.	3.5600	16.920	6.1500	-0.	4.6400	21.420	8.8300	-0.
310.00	1.2000	9.0000	5.0000	24.050	5.0100	-0.	2.6800	12.550	3.2900	-0.	-0.	-0.	-0.	-0.
311.00	1.1000	9.0000	4.5700	26.740	6.5700	-0.	3.0900	12.580	4.7900	-0.	4.0800	18.320	7.7900	-0.
311.00	1.2000	9.0000	3.9500	23.310	7.0500	-0.	2.3700	12.550	4.7400	-0.	-0.	-0.	-0.	-0.
312.00	1.1000	9.0000	4.9600	39.990	7.3900	-0.	3.3900	15.730	4.7500	-0.	4.8600	15.260	8.0600	-0.
312.00	1.2000	9.0000	5.3200	40.010	8.1500	-0.	3.1500	16.880	4.2800	-0.	-0.	-0.	-0.	-0.
313.00	1.1000	9.0000	4.3300	49.940	6.4100	-0.	2.2700	12.590	4.2100	-0.	3.6300	15.460	7.9700	-0.
313.00	1.2000	9.0000	4.1800	30.060	7.3400	-0.	2.3000	9.4300	4.5500	-0.	-0.	-0.	-0.	-0.
314.00	1.1000	3.0000	3.9500	34.930	5.9700	-0.	1.8200	11.420	3.1500	-0.	2.2300	20.240	4.1500	-0.
314.00	1.2000	3.0000	3.1600	34.690	3.4400	-0.	1.5600	11.590	2.4000	-0.	-0.	-0.	-0.	-0.
315.00	1.1000	3.0000	2.6100	22.050	5.5100	-0.	1.7600	11.890	4.1900	-0.	2.0500	20.180	5.2900	-0.
315.00	1.2000	3.0000	2.5500	26.330	4.2000	-0.	1.7500	11.890	2.4500	-0.	-0.	-0.	-0.	-0.
316.00	1.1000	3.0000	3.1700	31.510	3.9900	-0.	1.9800	8.9400	3.1600	-0.	2.2700	20.240	3.8000	-0.
316.00	1.2000	3.0000	3.0200	37.720	3.7400	-0.	1.7500	11.910	2.7000	-0.	-0.	-0.	-0.	-0.
317.00	1.1000	3.0000	2.7200	25.170	5.0800	-0.	1.7400	8.5100	3.3900	-0.	1.9900	11.520	4.6600	-0.
317.00	1.2000	3.0000	2.7700	25.360	5.3000	-0.	1.8300	8.9500	3.4200	-0.	-0.	-0.	-0.	-0.
318.00	1.1000	3.0000	2.3100	20.430	4.6900	-0.	1.3600	11.360	3.3300	-0.	1.7600	25.900	4.2200	-0.
318.00	1.2000	3.0000	2.7100	25.330	5.9700	-0.	1.2200	5.7500	3.8100	-0.	-0.	-0.	-0.	-0.
319.00	1.1000	3.0000	4.0100	37.290	4.1300	-0.	2.6200	20.640	3.2000	-0.	2.8800	31.470	4.1100	-0.
319.00	1.2000	3.0000	3.3600	33.860	3.4500	-0.	2.7200	17.590	3.2000	-0.	-0.	-0.	-0.	-0.
320.00	1.1000	3.0000	3.8700	69.250	6.2900	-0.	2.0000	15.540	4.9800	-0.	2.8000	48.580	5.0700	-0.
320.00	1.2000	3.0000	3.0700	55.510	7.3100	-0.	1.9900	12.410	5.1200	-0.	-0.	-0.	-0.	-0.
321.00	1.1000	3.0000	4.7700	53.360	9.3900	-0.	3.3700	34.350	6.1600	-0.	3.1800	36.580	7.5900	-0.
321.00	1.2000	3.0000	2.0300	-0.	5.7100	-0.	1.8000	-0.	3.0300	-0.	-0.	-0.	-0.	-0.
322.00	1.1000	3.0000	4.9600	66.070	6.7500	-0.	3.4400	47.000	3.7500	-0.	3.4300	42.570	6.5300	-0.
322.00	1.2000	3.0000	5.2500	76.570	5.7600	-0.	3.0300	37.670	4.3300	-0.	-0.	-0.	-0.	-0.
323.00	1.1000	7.0000	3.3200	53.000	6.9500	-0.	1.6500	21.980	5.7100	-0.	2.4600	33.520	7.0100	-0.
323.00	1.2000	7.0000	2.8700	50.010	5.5500	-0.	1.3500	18.860	3.4700	-0.	-0.	-0.	-0.	-0.
324.00	1.1000	13.000	3.1100	43.250	8.0100	-0.	2.1000	25.070	4.9400	-0.	2.0800	27.370	5.0100	-0.
324.00	1.2000	13.000	2.5800	29.910	7.4800	-0.	1.7800	21.940	3.1500	-0.	-0.	-0.	-0.	-0.
325.00	1.1000	7.0000	6.0500	90.360	6.7700	-0.	4.4300	63.040	4.7100	-0.	6.3900	55.060	7.2300	-0.
325.00	1.2000	7.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
326.00	1.1000	1.0000	2.6500	29.770	7.0900	-0.	2.3800	12.750	7.1800	-0.	3.5400	15.250	11.390	-0.
326.00	1.2000	1.0000	3.0100	36.580	9.4500	-0.	2.4600	9.4200	2.7300	-0.	-0.	-0.	-0.	-0.
327.00	1.1000	1.0000	2.7600	29.700	6.6900	-0.	2.2400	6.2700	4.0700	-0.	3.2200	9.1200	6.5000	-0.
327.00	1.2000	1.0000	6.4700	56.070	5.0100	-0.	1.7000	16.580	2.5800	-0.	-0.	-0.	-0.	-0.
328.00	1.1000	9.0000	3.0500	39.660	8.9900	-0.	1.7100	15.580	5.2500	-0.	2.6500	18.150	8.1800	-0.
328.00	1.2000	9.0000	3.6600	46.060	10.580	-0.	1.7900	15.540	6.4200	-0.	-0.	-0.	-0.	-0.
329.00	1.1000	3.0000	4.1200	52.470	8.2600	-0.	2.7900	21.710	6.2600	-0.	3.0700	24.080	6.4500	-0.
329.00	1.2000	3.0000	4.2100	48.990	5.8200	-0.	2.6300	17.540	4.0800	-0.	-0.	-0.	-0.	-0.
330.00	1.1000	9.0000	2.8600	27.480	9.5100	-0.	1.8200	14.610	5.9300	-0.	1.6000	6.5100	6.4500	-0.
330.00	1.2000	9.0000	4.7500	33.150	11.230	-0.	2.5300	14.430	6.7000	-0.	-0.	-0.	-0.	-0.
331.00	1.1000	3.0000	4.5600	46.880	6.8800	-0.	2.5100	18.780	4.7300	-0.	2.8000	21.270	7.0700	-0.
331.00	1.2000	3.0000	4.6600	46.970	5.3500	-0.	2.3100	12.580	3.4700	-0.	-0.	-0.	-0.	-0.
332.00	1.1000	9.0000	3.8600	47.350	4.4200	-0.	2.3200	29.860	2.7500	-0.	2.4200	31.880	4.2700	-0.
332.00	1.2000	9.0000	3.5500	44.130	3.0300	-0.	2.6100	38.810	2.5700	-0.	-0.	-0.	-0.	-0.
333.00	1.1000	9.0000	2.8000	63.490	5.1000	-0.	1.8800	20.860	3.5700	-0.	3.5400	20.240	5.1600	-0.
333.00	1.2000	9.0000	4.6000	34.800	4.0100	-0.	1.7100	26.900	2.5200	-0.	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

FLEET : TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
334.00	1.1000	3.0000	3.4200	47.470	4.1100	-0.	4.1100	26.040	4.2700	-0.	1.4500	14.450	4.0000	-0.
334.00	1.2000	3.0000	3.0300	59.700	3.8400	-0.	.65000	11.900	3.4900	-0.	-0.	-0.	-0.	-0.
335.00	1.1000	9.0000	2.0600	43.960	2.9100	-0.	2.0000	26.810	3.1300	-0.	3.1800	23.480	4.3500	-0.
335.00	1.2000	9.0000	3.6800	50.030	3.4500	-0.	1.6500	17.870	3.4400	-0.	-0.	-0.	-0.	-0.
336.00	1.1000	1.0000	2.5700	53.400	4.7000	-0.	1.7200	35.680	3.1000	-0.	1.9700	40.400	4.6000	-0.
336.00	1.2000	1.0000	3.2100	62.760	5.4100	-0.	2.6000	44.440	4.7300	-0.	-0.	-0.	-0.	-0.
337.00	1.1000	12.000	6.3900	59.060	4.6900	-0.	4.3600	20.650	3.0000	-0.	5.7200	45.970	3.5400	-0.
337.00	1.2000	12.000	4.3900	56.360	5.0300	-0.	3.1300	29.660	4.2900	-0.	-0.	-0.	-0.	-0.
338.00	1.1000	12.000	6.0100	101.96	4.6600	-0.	3.8700	65.180	4.4400	-0.	6.7900	97.760	2.9500	-0.
338.00	1.2000	12.000	4.5700	81.250	3.2300	-0.	2.8000	65.040	2.0200	-0.	-0.	-0.	-0.	-0.
339.00	1.1000	12.000	9.1500	85.220	5.2800	-0.	5.3300	41.510	4.6500	-0.	7.3100	60.420	4.6000	-0.
339.00	1.2000	12.000	4.2300	65.760	4.6700	-0.	3.5300	32.680	3.0500	-0.	-0.	-0.	-0.	-0.
340.00	1.1000	1.0000	3.2800	62.650	13.160	-0.	1.8500	26.700	7.0400	-0.	2.9900	43.190	6.4000	-0.
340.00	1.2000	1.0000	2.9800	45.960	7.5800	-0.	1.5400	14.840	5.9500	-0.	-0.	-0.	-0.	-0.
341.00	1.1000	1.0000	4.7900	59.450	7.0700	-0.	2.7400	20.730	6.3300	-0.	4.3200	25.870	7.6300	-0.
341.00	1.2000	1.0000	3.4400	46.750	5.6600	-0.	3.4800	20.720	3.6800	-0.	-0.	-0.	-0.	-0.
342.00	1.1000	4.0000	3.4900	40.910	7.4900	-0.	1.9600	26.040	5.9700	-0.	1.9500	25.850	6.6300	-0.
342.00	1.2000	4.0000	2.9400	47.060	5.2200	-0.	1.7200	29.660	3.3400	-0.	-0.	-0.	-0.	-0.
343.00	1.1000	3.0000	1.9500	47.040	4.3700	-0.	1.1400	20.700	3.4000	-0.	1.4500	25.820	4.0300	-0.
343.00	1.2000	3.0000	3.1300	50.450	3.4800	-0.	1.2200	17.790	3.5000	-0.	-0.	-0.	-0.	-0.
344.00	1.1000	9.0000	7.0500	153.11	3.4100	-0.	3.3000	77.030	2.8300	-0.	4.8700	100.62	3.6400	-0.
344.00	1.2000	9.0000	6.0200	121.86	5.0300	-0.	3.2100	65.020	3.5300	-0.	-0.	-0.	-0.	-0.
345.00	1.1000	7.0000	7.7300	71.890	2.1300	-0.	7.7600	41.540	1.6000	-0.	8.1000	43.190	2.0100	-0.
345.00	1.2000	7.0000	4.2400	62.550	7.2800	-0.	2.2900	29.730	4.8200	-0.	3.1800	40.400	6.9300	-0.
346.00	1.1000	10.000	4.2400	62.550	7.2600	-0.	2.2900	29.730	4.8200	-0.	3.1800	40.400	6.9900	-0.
346.00	1.2000	10.000	4.2100	43.900	9.9300	-0.	2.6300	23.720	7.2600	-0.	-0.	-0.	-0.	-0.
347.00	1.1000	3.0000	2.3400	26.240	5.5400	-0.	1.2000	11.890	4.1100	-0.	1.3400	11.530	6.3500	-0.
347.00	1.2000	3.0000	1.6700	37.430	6.0000	-0.	1.5100	20.730	4.0600	-0.	-0.	-0.	-0.	-0.
348.00	1.1000	5.0000	3.8400	68.730	10.410	-0.	4.1000	47.270	11.030	-0.	4.0800	45.870	11.620	-0.
348.00	1.2000	5.0000	3.8000	71.780	6.6200	-0.	3.1000	47.300	5.2000	-0.	-0.	-0.	-0.	-0.
349.00	1.1000	7.0000	5.9100	77.360	3.6500	-0.	5.1300	35.490	2.5700	-0.	7.6760	48.790	4.1300	-0.
349.00	1.2000	7.0000	7.5100	112.74	5.2000	-0.	4.2400	44.510	3.7000	-0.	-0.	-0.	-0.	-0.
350.00	1.1000	8.0000	4.9100	84.150	6.2400	-0.	3.0800	62.140	3.8000	-0.	4.1400	71.750	5.9600	-0.
350.00	1.2000	8.0000	4.8100	78.060	5.9800	-0.	3.4200	54.380	3.0800	-0.	-0.	-0.	-0.	-0.
351.00	1.1000	4.0000	3.1400	46.770	5.9500	-0.	3.4700	35.530	5.3700	-0.	4.1300	45.970	6.9900	-0.
351.00	1.2000	4.0000	4.7100	80.250	7.4700	-0.	3.2900	61.570	4.3800	-0.	-0.	-0.	-0.	-0.
352.00	1.1000	9.0000	3.9500	74.890	8.1400	-0.	3.4100	56.190	5.0800	-0.	4.7900	60.270	7.7200	-0.
352.00	1.2000	9.0000	2.6500	37.340	7.2600	-0.	1.6500	23.590	4.3500	-0.	-0.	-0.	-0.	-0.
353.00	1.1000	11.000	4.5200	62.030	4.0500	-0.	2.8000	32.430	3.4400	-0.	5.1900	40.050	4.2300	-0.
353.00	1.2000	11.000	5.2300	59.360	6.1700	-0.	2.2200	17.690	4.4500	-0.	-0.	-0.	-0.	-0.
354.00	1.1000	5.0000	5.3100	49.570	7.7000	-0.	3.1900	23.530	5.2400	-0.	3.1700	22.840	7.1400	-0.
354.00	1.2000	5.0000	5.1000	59.110	6.8400	-0.	3.6600	32.490	5.2100	-0.	-0.	-0.	-0.	-0.
355.00	1.1000	6.0000	6.5000	112.58	6.5200	-0.	4.8100	83.460	4.2200	-0.	6.9600	97.240	6.7200	-0.
355.00	1.2000	6.0000	4.6500	62.750	9.6300	-0.	2.7800	52.990	4.0500	-0.	-0.	-0.	-0.	-0.
356.00	1.1000	3.0000	2.4700	40.440	5.1400	-0.	1.0200	14.720	2.9700	-0.	1.3300	20.000	4.8200	-0.
356.00	1.2000	3.0000	3.8200	37.120	4.8400	-0.	1.7800	20.230	3.3500	-0.	-0.	-0.	-0.	-0.
357.00	1.1000	7.0000	2.5800	47.050	4.3000	-0.	1.3500	23.620	2.9500	-0.	1.5700	31.520	3.5600	-0.
357.00	1.2000	7.0000	1.6000	33.570	5.0500	-0.	1.0300	20.410	3.5000	-0.	-0.	-0.	-0.	-0.
358.00	1.1000	12.000	7.9200	89.580	3.0000	-0.	3.5800	64.370	2.1300	-0.	6.1300	73.620	2.5400	-0.
358.00	1.2000	12.000	6.7100	82.250	3.4800	-0.	3.2500	63.990	2.3600	-0.	-0.	-0.	-0.	-0.
359.00	1.1000	9.0000	4.8200	61.660	7.0600	-0.	2.4000	29.300	3.5400	-0.	3.0100	28.430	6.8300	-0.
359.00	1.2000	9.0000	4.1200	51.760	5.9700	-0.	2.4300	23.320	3.3100	-0.	-0.	-0.	-0.	-0.
360.00	1.1000	1.0000	7.1500	110.07	5.7700	-0.	6.1400	78.390	3.8200	-0.	8.0000	78.900	6.6400	-0.
360.00	1.2000	1.0000	3.6300	107.99	3.5000	-0.	2.7500	60.510	2.7000	-0.	-0.	-0.	-0.	-0.
361.00	1.1000	13.000	2.6600	16.220	9.2000	-0.	1.7700	8.7300	6.2700	-0.	1.9300	11.300	6.4800	-0.
361.00	1.2000	13.000	3.8600	16.010	11.460	-0.	1.9500	5.7600	4.8100	-0.	-0.	-0.	-0.	-0.
362.00	1.1000	3.0000	2.1700	45.120	4.3400	-0.	.73000	11.390	3.3800	-0.	2.0700	14.060	5.2400	-0.
362.00	1.2000	3.0000	3.6100	75.560	4.9000	-0.	1.9700	32.050	3.4100	-0.	-0.	-0.	-0.	-0.
363.00	1.1000	9.0000	4.6500	47.830	4.0400	-0.	2.6400	32.390	3.0300	-0.	3.4800	69.010	2.6400	-0.
363.00	1.2000	9.0000	3.0700	47.060	4.1700	-0.	6.2500	29.720	3.3400	-0.	-0.	-0.	-0.	-0.
364.00	1.1000	7.0000	5.8100	78.290	5.1800	-0.	3.0000	29.660	5.0400	-0.	6.2600	43.170	5.7200	-0.
364.00	1.2000	7.0000	3.1300	43.960	4.5700	-0.	1.6500	14.850	3.2400	-0.	-0.	-0.	-0.	-0.
365.00	1.1000	8.0000	3.8100	53.160	9.4400	-0.	1.6900	29.570	4.0300	-0.	2.5300	28.700	6.7100	-0.
365.00	1.2000	8.0000	3.3700	50.160	4.8900	-0.	1.4200	23.070	3.3600	-0.	-0.	-0.	-0.	-0.
366.00	1.1000	3.0000	2.7500	11.200	4.6800	-0.	1.3700	11.820	3.2500	-0.	1.8000	14.380	4.5300	-0.
366.00	1.2000	3.0000	3.2400	37.530	5.1700	-0.	1.8600	11.390	3.6500	-0.	-0.	-0.	-0.	-0.

65

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 3 TESTS 1A AND 10

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
367.00	1.1000	8.0000	3.7100	78.060	8.1100	-0.	2.7500	68.220	5.4600	-0.	3.5500	71.960	8.7500	-0.
367.00	1.2000	8.0000	3.4300	49.940	8.0300	-0.	2.3600	35.620	6.0600	-0.	-0.	-0.	-0.	-0.
368.00	1.1000	8.0000	4.7600	62.680	7.0500	-0.	2.5800	41.550	4.2900	-0.	4.2600	51.850	5.1400	-0.
368.00	1.2000	8.0000	5.1500	62.770	5.8100	-0.	2.8900	36.640	4.0400	-0.	-0.	-0.	-0.	-0.
369.00	1.1000	10.000	7.6500	194.68	2.2200	-0.	4.4500	130.50	2.1400	-0.	5.3300	143.92	2.4000	-0.
369.00	1.2000	10.000	6.2600	150.56	2.2100	-0.	3.9100	95.180	1.6300	-0.	-0.	-0.	-0.	-0.
370.00	1.1000	5.0000	4.0600	53.490	4.3400	-0.	2.6900	35.600	3.4300	-0.	2.9400	46.070	3.9300	-0.
370.00	1.2000	5.0000	3.0900	53.360	2.5300	-0.	2.2600	41.550	1.6900	-0.	-0.	-0.	-0.	-0.
371.00	1.1000	1.0000	2.3900	50.140	3.7400	-0.	2.3100	35.670	3.6900	-0.	3.1500	40.360	4.8500	-0.
371.00	1.2000	1.0000	3.1900	65.780	4.9700	-0.	2.3500	41.580	3.1900	-0.	-0.	-0.	-0.	-0.
372.00	1.1000	3.0000	2.4500	31.250	10.030	-0.	1.4900	14.620	8.1600	-0.	2.0400	25.890	10.110	-0.
372.00	1.2000	3.0000	1.9200	21.080	5.7100	-0.	1.7400	11.880	6.9000	-0.	-0.	-0.	-0.	-0.
373.00	1.1000	8.0000	3.4100	61.370	6.1800	-0.	2.1400	53.440	4.1300	-0.	2.3700	60.510	5.9600	-0.
373.00	1.2000	8.0000	2.8300	84.640	4.5600	-0.	1.9300	62.400	3.6500	-0.	-0.	-0.	-0.	-0.
374.00	1.1000	4.0000	3.7300	34.950	10.540	-0.	2.0700	11.660	7.5900	-0.	2.5200	11.510	9.3500	-0.
374.00	1.2000	4.0000	3.4500	37.280	6.8100	-0.	2.2800	14.840	5.1700	-0.	-0.	-0.	-0.	-0.
375.00	1.1000	9.0000	2.0200	37.580	2.8900	-0.	3.1000	65.300	2.4500	-0.	3.8300	69.130	2.9900	-0.
375.00	1.2000	9.0000	6.3900	106.94	2.5400	-0.	4.2800	92.170	1.7700	-0.	-0.	-0.	-0.	-0.
376.00	1.1000	3.0000	3.2700	34.430	6.9700	-0.	2.1200	20.750	4.7800	-0.	3.1700	23.010	5.3800	-0.
376.00	1.2000	3.0000	3.0800	37.630	4.4900	-0.	1.4100	23.790	3.2800	-0.	-0.	-0.	-0.	-0.
377.00	1.1000	13.000	3.9600	37.550	6.1100	-0.	2.2900	20.700	5.0400	-0.	2.5700	20.090	5.2500	-0.
377.00	1.2000	13.000	3.6400	18.900	5.5100	-0.	1.9800	17.810	4.3200	-0.	-0.	-0.	-0.	-0.
378.00	1.1000	9.0000	3.3600	50.300	5.4500	-0.	2.1600	29.680	4.1500	-0.	2.4800	48.970	4.4100	-0.
378.00	1.2000	9.0000	5.2600	61.480	6.2600	-0.	3.8800	59.400	4.8500	-0.	-0.	-0.	-0.	-0.
379.00	1.1000	7.0000	3.0500	34.440	3.2900	-0.	1.6100	17.800	3.2100	-0.	2.1600	25.900	3.1900	-0.
379.00	1.2000	7.0000	2.4300	34.510	4.5900	-0.	1.5400	17.840	3.7700	-0.	-0.	-0.	-0.	-0.
380.00	1.1000	9.0000	4.2900	62.560	5.7100	-0.	3.3200	59.400	3.2200	-0.	3.4400	63.410	4.0500	-0.
380.00	1.2000	9.0000	4.5300	72.080	4.0900	-0.	3.1000	44.590	4.3100	-0.	-0.	-0.	-0.	-0.
381.00	1.1000	9.0000	3.0500	43.680	5.0300	-0.	1.9200	32.510	3.8500	-0.	2.2500	37.290	4.6700	-0.
381.00	1.2000	9.0000	3.5900	53.300	5.4600	-0.	2.3800	32.650	4.6300	-0.	-0.	-0.	-0.	-0.
382.00	1.1000	10.000	2.9000	28.210	6.6600	-0.	1.7300	14.840	4.5400	-0.	1.9300	14.400	6.4800	-0.
382.00	1.2000	10.000	3.5700	34.370	8.4300	-0.	2.5600	23.740	5.4900	-0.	-0.	-0.	-0.	-0.
383.00	1.1000	5.0000	3.4700	65.700	6.9600	-0.	1.7000	8.8700	6.2300	-0.	1.9900	14.350	8.1900	-0.
383.00	1.2000	5.0000	2.8900	24.860	8.1700	-0.	2.7500	11.830	7.3300	-0.	-0.	-0.	-0.	-0.
384.00	1.1000	6.0000	3.5400	53.110	9.0000	-0.	2.4300	29.660	9.3700	-0.	2.8100	34.540	8.7800	-0.
384.00	1.2000	6.0000	5.9200	65.960	8.7100	-0.	2.3600	23.650	6.9800	-0.	-0.	-0.	-0.	-0.
385.00	1.1000	7.0000	3.3800	103.25	4.7900	-0.	2.1300	59.360	3.3400	-0.	3.4200	86.410	3.7800	-0.
385.00	1.2000	7.0000	4.2800	100.18	4.1000	-0.	2.2000	44.390	3.1700	-0.	-0.	-0.	-0.	-0.
386.00	1.1000	3.0000	4.4400	34.570	7.7600	-0.	1.7600	14.800	5.8300	-0.	2.0900	20.110	6.8400	-0.
386.00	1.2000	3.0000	5.0400	41.140	7.1000	-0.	2.3800	17.750	5.0900	-0.	-0.	-0.	-0.	-0.
387.00	1.1000	7.0000	4.8600	134.08	4.0700	-0.	4.0900	82.990	4.2200	-0.	5.2100	135.19	2.9300	-0.
387.00	1.2000	7.0000	5.0000	121.97	4.1700	-0.	3.0500	61.950	3.2000	-0.	-0.	-0.	-0.	-0.
388.00	1.1000	8.0000	4.4100	65.620	1.8100	-0.	3.9300	71.060	1.2400	-0.	5.6100	74.700	1.2000	-0.
388.00	1.2000	8.0000	3.9300	46.770	1.8800	-0.	3.5900	56.070	1.7400	-0.	-0.	-0.	-0.	-0.
389.00	1.1000	9.0000	5.6600	65.450	4.3500	-0.	5.2400	53.290	3.1300	-0.	6.8000	48.850	3.9200	-0.
389.00	1.2000	9.0000	4.4200	53.510	4.3000	-0.	2.4100	31.480	3.0500	-0.	-0.	-0.	-0.	-0.
390.00	1.1000	4.0000	2.5400	37.520	8.4500	-0.	1.9200	23.730	7.0800	-0.	2.2900	23.030	8.0600	-0.
390.00	1.2000	4.0000	3.0300	65.180	7.8000	-0.	2.1700	38.350	5.6300	-0.	-0.	-0.	-0.	-0.
391.00	1.1000	5.0000	5.4500	111.67	6.4100	-0.	2.9400	26.570	7.5600	-0.	3.7500	37.250	6.7500	-0.
391.00	1.2000	5.0000	3.4900	37.130	7.2600	-0.	3.0800	14.910	6.5100	-0.	-0.	-0.	-0.	-0.
392.00	1.1000	9.0000	2.5800	31.030	6.5300	-0.	1.9300	20.670	4.2000	-0.	2.3400	25.800	5.6900	-0.
392.00	1.2000	9.0000	3.3800	42.590	7.0800	-0.	2.3700	25.640	4.7400	-0.	-0.	-0.	-0.	-0.
393.00	1.1000	3.0000	3.3200	52.850	4.4600	-0.	3.2900	58.830	3.9900	-0.	2.9200	54.320	5.3700	-0.
393.00	1.2000	3.0000	3.6800	31.970	5.1900	-0.	1.4800	8.5600	3.3300	-0.	-0.	-0.	-0.	-0.
394.00	1.1000	3.0000	3.7700	28.150	4.8100	-0.	1.8500	11.830	3.5500	-0.	2.4400	14.350	5.7200	-0.
394.00	1.2000	3.0000	3.4100	25.640	5.1500	-0.	2.6700	14.990	3.9900	-0.	-0.	-0.	-0.	-0.
395.00	1.1000	9.0000	2.8400	53.060	4.7400	-0.	1.6900	15.040	5.3500	-0.	2.9600	17.740	5.3700	-0.
395.00	1.2000	9.0000	4.0100	69.370	4.7600	-0.	1.3800	15.880	3.3400	-0.	-0.	-0.	-0.	-0.
396.00	1.1000	3.0000	6.5100	55.680	6.7600	-0.	4.0000	20.580	4.9000	-0.	4.1800	22.820	7.0700	-0.
396.00	1.2000	3.0000	5.6800	41.230	5.4700	-0.	4.5600	27.550	4.7400	-0.	-0.	-0.	-0.	-0.
397.00	1.1000	8.0000	3.5000	37.010	9.3700	-0.	1.8000	18.170	6.6800	-0.	2.0000	20.190	9.6700	-0.
397.00	1.2000	8.0000	2.4800	33.310	6.5700	-0.	1.4700	17.380	4.0100	-0.	-0.	-0.	-0.	-0.
398.00	1.1000	8.0000	4.4600	46.180	7.1800	-0.	2.2400	11.710	5.6700	-0.	3.0200	19.880	7.1200	-0.
398.00	1.2000	8.0000	15.750	99.310	6.8500	-0.	2.7600	17.340	5.9900	-0.	-0.	-0.	-0.	-0.
399.00	1.1000	3.0000	4.0200	55.380	5.3400	-0.	1.9600	15.900	3.9700	-0.	2.2600	21.410	5.0700	-0.
399.00	1.2000	3.0000	3.5700	36.180	6.4700	-0.	2.1300	17.300	4.4000	-0.	-0.	-0.	-0.	-0.

TABLE 1

SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
400.00	1.1000	2.0000	2.3000	24.510	8.3300	-0.	7.60000E-0	17.410	5.2200	-0.	1.0300	14.080	8.7900	-0.
400.00	1.2000	2.0000	2.3800	48.060	6.9500	-0.	.99000	15.100	5.2400	-0.	-0.	-0.	-0.	-0.
401.00	1.1000	1.0000	3.9500	5.0400	6.0900	-0.	2.9800	45.490	4.0200	-0.	2.6900	47.780	5.4800	-0.
401.00	1.2000	1.0000	3.4400	58.860	3.7900	-0.	2.0400	28.710	2.9600	-0.	-0.	-0.	-0.	-0.
402.00	1.1000	9.0000	3.5300	71.460	6.5100	-0.	1.7900	36.330	4.3900	-0.	3.0000	52.880	6.0200	-0.
402.00	1.2000	9.0000	2.8000	30.430	7.0300	-0.	1.4300	8.1800	4.4900	-0.	-0.	-0.	-0.	-0.
403.00	1.1000	9.0000	4.8200	61.960	7.0700	-0.	1.7100	15.430	5.2300	-0.	4.5400	22.020	7.2300	-0.
403.00	1.2000	9.0000	5.4100	58.950	10.840	-0.	2.0900	13.000	6.2300	-0.	-0.	-0.	-0.	-0.
404.00	1.1000	9.0000	3.1400	77.310	5.6600	-0.	.84000	24.340	4.1000	-0.	1.2500	29.520	6.7400	-0.
404.00	1.2000	9.0000	4.3300	60.470	7.2400	-0.	1.3900	15.410	4.5400	-0.	-0.	-0.	-0.	-0.
405.00	1.1000	9.0000	4.7200	123.31	7.1500	-0.	3.2900	72.140	4.5200	-0.	4.7600	71.180	7.3800	-0.
405.00	1.2000	9.0000	6.0700	127.97	7.6600	-0.	2.4400	31.140	4.7500	-0.	-0.	-0.	-0.	-0.
406.00	1.1000	10.000	5.3100	41.090	7.3600	-0.	2.0400	17.520	4.9400	-0.	2.8500	18.170	8.0200	-0.
406.00	1.2000	10.000	3.4800	42.690	8.4200	-0.	1.3900	16.340	4.4100	-0.	-0.	-0.	-0.	-0.
407.00	1.1000	7.0000	13.760	192.75	1.4200	-0.	7.8900	135.31	1.4300	-0.	10.400	214.26	1.2500	-0.
407.00	1.2000	7.0000	23.980	174.35	2.3100	-0.	5.0900	83.030	1.8000	-0.	-0.	-0.	-0.	-0.
408.00	1.1000	5.0000	2.9000	29.130	5.2300	-0.	2.7500	8.1800	4.9100	-0.	3.4100	12.640	5.1400	-0.
408.00	1.2000	5.0000	3.6000	12.390	6.0800	4.6900	1.9700	4.8600	5.2300	4.3800	-0.	-0.	-0.	-0.
409.00	1.1000	4.0000	10.230	236.07	2.4100	-0.	2.1300	32.410	4.1500	-0.	2.7700	32.630	5.6900	-0.
409.00	1.2000	4.0000	5.8500	31.800	7.7500	-0.	2.6300	11.790	5.3400	-0.	-0.	-0.	-0.	-0.
410.00	1.1000	9.0000	4.7600	121.24	5.0000	-0.	2.3500	57.420	4.0700	-0.	2.6800	67.460	6.0100	-0.
410.00	1.2000	9.0000	4.1500	58.230	5.5300	-0.	2.8800	12.990	5.1300	-0.	-0.	-0.	-0.	-0.
411.00	1.1000	9.0000	5.0300	50.550	5.9300	4.0400	3.0800	25.010	4.3600	3.3000	4.1200	30.120	5.9100	4.4000
411.00	1.2000	9.0000	4.6500	62.830	5.8100	-0.	2.5200	24.790	4.1100	-0.	-0.	-0.	-0.	-0.
412.00	1.1000	4.0000	2.6900	49.600	9.5900	-0.	1.4500	25.150	6.8600	-0.	2.2800	31.470	7.8500	-0.
412.00	1.2000	4.0000	3.2200	25.530	10.360	7.2400	1.5700	13.010	6.6800	5.3800	-0.	-0.	-0.	-0.
413.00	1.1000	3.0000	6.6500	87.110	8.3000	-0.	3.9900	48.970	5.9200	-0.	4.9200	48.990	8.7300	-0.
413.00	1.2000	3.0000	5.8200	98.680	7.0200	4.8200	3.6800	51.770	4.2100	3.2100	-0.	-0.	-0.	-0.
414.00	1.1000	3.0000	5.7100	83.160	5.9900	4.1100	2.5400	16.560	4.9200	3.7500	3.1100	28.930	6.3000	4.6100
414.00	1.2000	3.0000	5.1400	60.090	7.4200	5.9300	3.0600	13.880	5.4000	4.9500	-0.	-0.	-0.	-0.
415.00	1.1000	9.0000	3.2400	60.550	7.4700	5.2100	1.6200	18.810	4.7300	3.8100	1.8200	22.080	7.7400	6.0900
415.00	1.2000	9.0000	2.3700	16.010	7.6300	5.9200	1.3400	11.800	4.8900	4.1300	-0.	-0.	-0.	-0.
416.00	1.1000	5.0000	5.6200	67.490	5.9400	4.0500	2.9700	59.410	3.7300	2.8200	4.0100	60.290	5.7700	4.3800
416.00	1.2000	5.0000	3.9200	24.190	6.3900	4.5200	2.2800	13.010	4.2400	3.2800	-0.	-0.	-0.	-0.
417.00	1.1000	5.0000	6.2000	99.570	7.1300	5.1100	3.2000	44.980	5.8700	4.9300	3.3700	46.290	6.7600	5.3300
417.00	1.2000	5.0000	5.5400	107.19	8.3400	6.0800	3.7900	49.400	7.7800	6.2700	-0.	-0.	-0.	-0.
418.00	1.1000	9.0000	4.3300	141.32	5.1200	4.1300	5.7600	99.110	3.6100	3.3300	4.8400	109.42	5.9200	4.6400
418.00	1.2000	9.0000	5.3400	114.65	5.1600	4.0400	4.6900	86.040	3.2100	2.6800	-0.	-0.	-0.	-0.
419.00	1.1000	8.0000	4.2600	59.050	5.6400	4.0400	2.8000	41.100	3.4900	2.9200	3.6300	51.330	5.3800	4.2400
419.00	1.2000	8.0000	4.1800	67.320	4.9900	3.8000	2.7300	42.370	3.7200	3.2800	-0.	-0.	-0.	-0.
420.00	1.1000	1.0000	4.1300	47.970	8.1300	6.6700	3.6500	25.140	6.0600	5.5400	4.8100	26.760	9.0300	8.2300
420.00	1.2000	1.0000	4.5500	44.660	7.7300	5.7900	2.6200	21.160	6.4100	5.6300	-0.	-0.	-0.	-0.
421.00	1.1000	10.000	4.3700	88.710	7.1500	5.7000	2.7000	42.400	5.1500	4.4400	3.5800	54.080	7.5200	6.2400
421.00	1.2000	10.000	4.1300	114.01	5.1500	4.1800	1.8000	31.150	4.0500	3.7000	-0.	-0.	-0.	-0.
422.00	1.1000	4.0000	4.6800	79.310	6.6500	4.7400	2.3400	50.210	4.4100	3.3900	3.2300	56.650	6.4600	4.4700
422.00	1.2000	4.0000	2.8000	39.740	7.6700	5.6800	2.1800	19.930	5.9000	4.5700	-0.	-0.	-0.	-0.
423.00	1.1000	9.0000	6.0500	157.60	5.3200	-0.	3.4200	97.920	3.9300	-0.	3.6700	106.18	5.6900	-0.
423.00	1.2000	9.0000	9.3800	209.48	4.2900	3.4900	3.1000	94.690	2.6400	2.6000	-0.	-0.	-0.	-0.
424.00	1.1000	3.0000	3.7200	21.610	5.2900	-0.	2.0100	8.4700	3.7700	4.1600	2.1700	10.280	5.4600	-0.
424.00	1.2000	3.0000	2.6700	26.560	4.9900	3.9200	1.8000	11.780	3.8700	3.1300	-0.	-0.	-0.	-0.
425.00	1.1000	5.0000	5.8200	115.77	5.7600	4.5200	3.0300	16.340	5.8100	5.0000	3.6800	22.900	8.0900	6.7800
425.00	1.2000	5.0000	4.2600	57.180	7.1200	5.8500	2.7400	18.700	6.2900	5.7700	-0.	-0.	-0.	-0.
426.00	1.1000	3.0000	2.3000	16.270	4.0100	3.5400	1.5300	7.6600	2.9400	2.6200	1.6900	11.570	3.9700	3.5100
426.00	1.2000	3.0000	2.4900	15.880	4.4600	4.0900	1.8300	6.9300	3.5300	3.3500	-0.	-0.	-0.	-0.
427.00	1.1000	3.0000	6.3200	39.500	4.2200	3.5900	4.8400	23.740	3.9300	2.8800	5.2600	36.160	4.2100	3.3300
427.00	1.2000	3.0000	7.1000	51.660	3.6800	2.9600	4.5000	19.790	3.3200	2.6900	-0.	-0.	-0.	-0.
428.00	1.1000	9.0000	4.7200	75.840	7.2500	5.3500	3.1600	59.260	4.6200	3.5100	4.3200	65.400	7.2200	5.6900
428.00	1.2000	9.0000	4.0000	70.830	5.3500	4.5000	2.5500	47.290	3.8400	3.5600	-0.	-0.	-0.	-0.
429.00	1.1000	6.0000	3.8700	39.460	8.3900	6.8200	2.7200	24.640	6.4400	5.0800	4.3300	36.170	8.4200	6.8300
429.00	1.2000	6.0000	4.8500	55.010	8.0400	6.9900	2.6500	26.200	6.4300	6.0300	-0.	-0.	-0.	-0.
430.00	1.1000	5.0000	8.1500	110.72	6.5400	5.2800	4.4000	79.790	5.0900	4.0000	6.0900	77.430	7.9700	6.4000
430.00	1.2000	5.0000	5.6300	50.380	7.2300	5.9200	2.8500	22.990	4.4500	4.0700	-0.	-0.	-0.	-0.
431.00	1.1000	3.0000	3.6600	79.970	4.0600	3.0100	2.1000	17.450	4.2200	3.1300	2.4800	27.740	5.3800	4.1800
431.00	1.2000	3.0000	4.6900	72.750	3.9200	3.8100	1.7500	27.150	3.8600	3.9600	-0.	-0.	-0.	-0.
432.00	1.1000	1.0000	3.8100	69.510	3.8200	2.9900	2.9900	39.720	2.7700	2.2100	4.1600	38.540	5.1600	4.4000
432.00	1.2000	1.0000	4.1800	66.040	4.9100	4.4700	3.2700	46.030	4.3300	4.0100	-0.	-0.	-0.	-0.

67

TABLE 1

SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST.NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
433.00	1.1000	8.0000	3.3200	62.800	3.6200	3.3200	1.5300	26.730	2.6800	2.1200	3.2300	49.020	3.0600	2.6000
433.00	1.2000	8.0000	9.4200	145.10	2.0600	2.0600	3.1500	51.620	1.7900	1.7500	-0.	-0.	-0.	-0.
434.00	1.1000	9.0000	5.0100	107.50	4.1900	3.4000	2.9100	75.560	2.7700	2.5200	3.7700	87.300	4.4200	3.7500
434.00	1.2000	9.0000	4.4300	78.300	3.9100	3.7700	2.0400	24.750	2.7500	2.6600	-0.	-0.	-0.	-0.
435.00	1.1000	8.0000	6.3500	141.53	2.7400	2.0800	4.4100	118.78	2.2600	1.5400	5.1500	89.720	3.8200	2.9400
435.00	1.2000	8.0000	7.0900	154.64	2.1500	2.1900	4.3300	117.05	1.3000	1.2200	-0.	-0.	-0.	-0.
436.00	1.1000	2.0000	2.6200	65.440	6.1800	5.6500	1.1800	21.030	5.3400	5.3400	1.6600	16.910	7.2600	-0.
436.00	1.2000	2.0000	2.9800	63.890	6.0300	-0.	.99000	11.710	4.7100	-0.	-0.	-0.	-0.	-0.
437.00	1.1000	8.0000	8.1500	103.65	6.8000	5.8800	2.8600	60.790	5.5600	5.2100	3.8600	72.140	7.5100	6.5300
437.00	1.2000	8.0000	4.8900	81.670	7.3200	-0.	2.9600	51.500	4.9100	-0.	-0.	-0.	-0.	-0.
438.00	1.1000	12.000	8.1400	104.17	3.1300	3.3300	4.3800	59.500	3.2500	2.9700	6.9800	99.440	2.9700	2.2800
438.00	1.2000	12.000	4.8900	52.840	5.5400	4.6900	2.7700	23.770	3.6600	3.2100	-0.	-0.	-0.	-0.
439.00	1.1000	8.0000	8.5300	129.56	3.0500	-0.	2.3800	33.300	3.3400	-0.	2.6100	36.100	4.5700	-0.
439.00	1.2000	8.0000	4.4100	78.530	4.3900	4.1000	2.8800	52.600	3.4600	3.3700	-0.	-0.	-0.	-0.
440.00	1.1000	10.000	3.3600	40.730	6.7200	-0.	1.3900	9.3000	4.3500	-0.	2.5600	10.190	6.7900	-0.
440.00	1.2000	10.000	4.5100	79.540	6.5900	5.7300	1.6500	17.470	4.8700	4.3700	-0.	-0.	-0.	-0.
441.00	1.1000	12.000	7.0400	66.280	3.2700	-0.	2.5600	29.700	3.4200	-0.	2.7900	47.160	2.8400	-0.
441.00	1.2000	12.000	4.1700	57.950	4.1300	3.9900	2.0900	16.680	3.3100	3.2600	-0.	-0.	-0.	-0.
442.00	1.1000	6.0000	8.7100	102.89	6.8000	5.7300	5.2600	65.180	5.3300	4.7100	6.4500	75.270	7.1500	6.1900
442.00	1.2000	6.0000	5.6900	65.840	5.6100	3.4100	5.4200	31.060	4.7200	3.2600	-0.	-0.	-0.	-0.
443.00	1.1000	8.0000	5.8700	98.260	6.7700	5.5900	3.3600	60.790	4.6100	3.8800	4.9100	73.590	6.8300	5.5600
443.00	1.2000	8.0000	6.4700	84.830	6.0300	3.8200	3.2500	47.600	5.2200	3.8500	-0.	-0.	-0.	-0.
444.00	1.1000	12.000	5.5600	138.11	1.0800	.85000	2.4400	64.240	1.5500	1.2000	4.3100	69.040	1.8100	1.6300
444.00	1.2000	12.000	5.6000	80.640	2.3900	1.5600	3.4400	62.080	1.5100	.96000	-0.	-0.	-0.	-0.
445.00	1.1000	13.000	3.9400	26.470	4.9000	4.3800	2.9100	32.390	3.2400	3.0100	-0.	-0.	-0.	-0.
445.00	1.2000	13.000	4.3200	30.340	4.6500	2.8700	3.5400	15.080	4.5800	3.6400	-0.	-0.	-0.	-0.
446.00	1.1000	13.000	5.1400	47.380	4.1800	2.7200	2.5700	23.740	3.9500	2.6600	3.9700	32.360	3.0800	2.2100
446.00	1.2000	13.000	4.6700	48.310	2.8000	-0.	2.7200	32.220	2.7000	-0.	-0.	-0.	-0.	-0.
447.00	1.1000	13.000	3.6300	47.330	2.8300	1.6800	1.4300	23.710	2.1800	1.5600	1.5100	21.840	2.7200	1.9000
447.00	1.2000	13.000	2.6800	39.470	1.6600	1.4500	1.0100	22.320	1.3700	1.1300	-0.	-0.	-0.	-0.
448.00	1.1000	13.000	2.9200	33.960	7.3300	4.3200	2.0600	18.580	4.1000	4.0600	2.1300	19.300	6.3300	4.5700
448.00	1.2000	13.000	3.4900	38.990	7.5300	-0.	2.5000	27.050	5.1300	-0.	-0.	-0.	-0.	-0.
449.00	1.1000	12.000	3.8100	51.860	4.5100	3.0400	2.1900	27.400	4.2900	5.0900	3.1700	31.270	4.2900	3.3400
449.00	1.2000	12.000	3.2500	43.220	3.0700	2.2100	1.3800	21.110	2.2200	1.8100	-0.	-0.	-0.	-0.
450.00	1.1000	13.000	2.3000	28.860	6.0400	3.4600	1.6400	15.320	3.9200	2.9700	1.6800	16.910	4.7200	3.3000
450.00	1.2000	13.000	3.8500	41.960	5.2200	-0.	1.8000	49.630	3.5500	-0.	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			4.4128	60.625	5.8767	4.2510	2.5944	31.720	4.3122	3.5478	3.5245	40.949	5.0766	4.5532
ESTIMATE OF STANDARD DEVIATION			2.0594	34.546	1.9993	1.4063	1.0645	22.911	1.4561	1.2387	1.6128	29.633	1.9883	1.6494
DEGREES OF FREEDOM			298	297	298	67	298	297	297	68	149	149	149	30
T VALUE			37.052	30.295	50.827	24.892	42.144	23.900	51.123	23.792	26.766	16.811	30.199	15.370

TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR ID	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
301.00	2.0000	3.0000	3.7000	35.550	5.4600	5.2800	2.3100	9.1500	4.1100	4.1100	-0.	-0.	-0.	-0.
302.00	2.0000	3.0000	4.2300	33.700	3.9400	3.8000	2.2400	6.9600	2.9400	2.9900	-0.	-0.	-0.	-0.
303.00	2.0000	3.0000	5.1300	31.530	-0.	3.9500	2.1500	11.460	-0.	3.1700	-0.	-0.	-0.	-0.
304.00	2.0000	9.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
305.00	2.0000	9.0000	5.2500	69.510	5.9400	5.7600	2.7300	28.380	4.2100	4.1700	-0.	-0.	-0.	-0.
306.00	2.0000	9.0000	4.3600	56.770	5.5200	4.5100	-0.	-0.	-0.	-0.	2.1700	16.400	3.8900	3.4500
307.00	2.0000	9.0000	4.3200	58.400	5.4600	-0.	2.5400	22.480	3.5000	-0.	-0.	-0.	-0.	-0.
308.00	2.0000	9.0000	4.3800	60.780	6.5900	-0.	2.4300	50.030	3.6800	-0.	-0.	-0.	-0.	-0.
309.00	2.0000	9.0000	4.0600	32.200	6.5500	-0.	2.2900	6.0800	1.8800	-0.	-0.	-0.	-0.	-0.
310.00	2.0000	9.0000	3.7600	30.300	5.4500	-0.	-0.	-0.	-0.	-0.	2.1400	11.270	3.3700	-0.
311.00	2.0000	9.0000	4.0500	14.550	8.0600	6.8300	2.0900	5.6600	4.6500	4.3000	-0.	-0.	-0.	-0.
312.00	2.0000	9.0000	3.5800	46.640	5.6400	4.9800	2.0100	15.900	3.7600	3.5600	-0.	-0.	-0.	-0.
313.00	2.0000	9.0000	3.0500	26.610	5.5900	5.2000	1.8500	12.490	3.7700	3.7300	-0.	-0.	-0.	-0.
315.00	2.0000	3.0000	3.4300	33.070	4.2000	4.0100	1.9800	9.0900	2.9000	2.9400	-0.	-0.	-0.	-0.
316.00	2.0000	3.0000	2.9700	23.450	4.3400	3.9500	2.0900	11.470	2.8400	2.7500	-0.	-0.	-0.	-0.
317.00	2.0000	3.0000	5.6100	58.850	5.2000	-0.	2.5800	9.0600	4.0500	-0.	-0.	-0.	-0.	-0.
318.00	2.0000	3.6000	3.7100	45.780	5.2600	4.6200	1.8900	5.7600	3.3800	3.3000	-0.	-0.	-0.	-0.
319.00	2.0000	3.0000	4.6920	30.260	4.3773	4.4560	2.3300	6.1200	3.4200	3.5800	-0.	-0.	-0.	-0.
320.00	2.0000	3.0000	4.6800	46.480	6.4200	5.7800	3.1000	14.000	4.6700	4.7400	-0.	-0.	-0.	-0.
321.00	2.0000	3.0000	5.1100	56.380	6.9700	-0.	3.1300	38.020	5.0400	-0.	-0.	-0.	-0.	-0.
322.00	2.0000	3.0000	3.4500	30.690	6.1300	5.9000	2.5200	17.210	4.6000	5.0200	-0.	-0.	-0.	-0.
323.00	2.0000	7.0000	4.2000	67.430	5.1900	2.7200	2.2500	32.550	3.6300	2.1000	-0.	-0.	-0.	-0.
324.00	2.0000	13.000	2.7600	38.670	6.0900	5.4800	1.5700	16.080	3.5700	3.6600	-0.	-0.	-0.	-0.
325.00	2.0000	7.0000	5.1400	74.470	-0.	4.7000	2.5400	32.850	-0.	4.2600	-0.	-0.	-0.	-0.
326.00	2.0000	1.0000	3.4900	40.850	8.2600	7.7600	3.2700	15.840	6.4300	6.9000	-0.	-0.	-0.	-0.
327.00	2.0000	1.0000	4.5900	44.170	6.6800	5.9100	2.3400	12.790	3.6000	3.2600	-0.	-0.	-0.	-0.
328.00	2.0000	9.0000	4.3600	61.530	5.6100	5.0000	2.1000	33.430	3.8100	3.5900	-0.	-0.	-0.	-0.
329.00	2.0000	3.0000	7.8700	116.60	4.3000	4.8400	3.9700	26.930	4.1900	4.6600	-0.	-0.	-0.	-0.
330.00	2.0000	9.0000	5.4300	50.490	7.7700	6.7200	1.7300	13.980	4.8400	4.4300	-0.	-0.	-0.	-0.
331.00	2.0000	3.0000	4.0200	35.270	5.0200	4.8800	2.2400	13.480	3.5700	3.7900	-0.	-0.	-0.	-0.
332.00	2.0000	9.0000	4.7800	61.230	4.5700	4.6700	3.1900	39.410	3.1300	3.3500	-0.	-0.	-0.	-0.
333.00	2.0000	9.0000	2.7400	50.020	4.2000	4.1700	1.4600	18.550	2.4700	2.4300	-0.	-0.	-0.	-0.
334.00	2.0000	3.0000	5.3700	71.540	5.3400	5.1600	1.6400	17.190	4.4200	4.7500	-0.	-0.	-0.	-0.
335.00	2.0000	9.0000	4.4800	42.310	2.9500	2.0200	1.4000	23.210	2.5000	2.0600	-0.	-0.	-0.	-0.
336.00	2.0000	1.0000	3.3400	68.150	4.6200	4.3900	2.0700	36.480	3.0100	3.3100	-0.	-0.	-0.	-0.
337.00	2.0000	12.000	3.9000	54.030	4.6700	3.6700	2.0900	29.000	3.2000	2.7600	-0.	-0.	-0.	-0.
338.00	2.0000	12.000	4.1400	60.460	3.6400	3.2800	2.6700	30.180	2.7700	2.2300	-0.	-0.	-0.	-0.
339.00	2.0000	12.000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
340.00	2.0000	1.0000	5.3893	55.161	-0.	3.6680	2.8200	42.930	1.8500	2.2100	-0.	-0.	-0.	-0.
341.00	2.0000	1.0000	3.5500	51.760	5.4000	4.4600	2.1100	22.070	3.6400	3.1000	-0.	-0.	-0.	-0.
342.00	2.0000	4.0000	3.4700	55.650	5.4200	5.1400	2.2900	32.480	4.2800	3.8100	-0.	-0.	-0.	-0.
343.00	2.0000	3.0000	2.1500	48.100	5.0700	4.6900	1.9700	26.890	3.6300	3.6700	-0.	-0.	-0.	-0.
344.00	2.0000	9.0000	6.2200	160.15	3.1100	2.8200	2.4900	54.230	2.6600	2.4300	-0.	-0.	-0.	-0.
345.00	2.0000	10.000	5.5300	95.510	4.6200	4.6200	2.2100	30.200	2.6600	2.7800	-0.	-0.	-0.	-0.
347.00	2.0000	3.0000	3.5900	60.090	4.7100	4.7900	1.7400	10.260	3.7700	3.9600	-0.	-0.	-0.	-0.
348.00	2.0000	5.0000	5.1400	97.490	5.1900	4.6200	2.9900	56.900	3.7200	3.5100	-0.	-0.	-0.	-0.
349.00	2.0000	7.0000	9.0000	195.19	1.8500	1.7700	5.7600	155.05	1.2500	1.0500	-0.	-0.	-0.	-0.
350.00	2.0000	5.0000	3.5000	50.430	4.5800	4.0700	2.4000	37.660	3.3200	3.1300	-0.	-0.	-0.	-0.
351.00	2.0000	4.0000	5.7800	64.270	6.2100	5.1900	2.4000	25.140	-0.	4.0000	-0.	-0.	4.3900	-0.
352.00	2.0000	9.0000	3.2400	45.090	6.2400	5.4600	1.4800	11.190	4.7300	4.3800	-0.	-0.	-0.	-0.
353.00	2.0000	11.000	5.7500	78.350	3.9800	3.6300	2.7100	42.950	4.3300	3.7900	-0.	-0.	-0.	-0.
354.00	2.0000	5.0000	4.3500	67.960	3.5700	3.5700	2.6100	40.730	2.5200	2.3000	-0.	-0.	-0.	-0.
355.00	2.0000	5.0000	3.6200	53.790	5.5700	4.0900	1.9800	25.910	4.1400	3.1600	-0.	-0.	-0.	-0.
356.00	2.0000	3.0000	2.6700	17.490	3.8200	3.4800	.97000	4.5600	2.3700	2.1400	-0.	-0.	-0.	-0.
357.00	2.0000	7.0000	1.5100	36.370	3.0300	2.7800	1.0800	17.970	2.3600	2.2100	-0.	-0.	-0.	-0.
358.00	2.0000	12.000	7.0000	79.330	2.2600	2.6700	3.6800	60.950	1.9800	1.8700	-0.	-0.	-0.	-0.
359.00	2.0000	9.0000	5.5000	79.470	4.5700	4.2200	2.7900	26.650	3.0300	2.7800	-0.	-0.	-0.	-0.
360.00	2.0000	1.0000	4.5100	110.93	3.0600	3.1500	2.7100	70.930	2.1000	2.0100	-0.	-0.	-0.	-0.
363.00	2.0000	9.0000	4.1100	67.170	3.2400	2.9900	2.4900	40.760	2.9000	2.7800	-0.	-0.	-0.	-0.
364.00	2.0000	7.0000	3.6700	55.570	3.6000	3.9000	1.9800	19.290	3.3500	3.2300	-0.	-0.	-0.	-0.
365.00	2.0000	8.0000	3.8000	47.640	3.5400	3.8200	2.1700	29.290	2.6600	2.5800	-0.	-0.	-0.	-0.
366.00	2.0000	3.0000	3.6300	57.300	4.2900	4.0360	1.9600	18.120	3.5400	3.1400	-0.	-0.	-0.	-0.
367.00	2.0000	8.0000	4.0600	84.120	7.1500	6.6700	2.8400	76.480	4.2300	5.2300	-0.	-0.	-0.	-0.
368.00	2.0000	8.0000	5.3000	66.620	4.8900	3.9600	3.4600	44.920	3.1900	2.6700	-0.	-0.	-0.	-0.
369.00	2.0000	10.000	6.7600	159.76	1.9500	2.1600	4.2200	91.830	1.5900	1.5100	-0.	-0.	-0.	-0.
370.00	2.0000	5.0000	4.4800	46.190	2.6700	2.9100	2.2200	21.800	2.8600	2.3700	-0.	-0.	-0.	-0.

69

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72COLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
371.00	2.0000	1.0000	7.1000	259.59	1.0900	.97000	4.2800	160.19	.72000	.50000	-0.	-0.	-0.	-0.
372.00	2.0000	3.0000	4.1600	70.360	5.7300	5.1000	1.6100	9.4100	4.4300	4.1700	-0.	-0.	-0.	-0.
373.00	2.0000	8.0000	2.7707	79.567	3.2000	2.6273	2.2400	51.140	1.9400	2.1000	-0.	-0.	-0.	-0.
374.00	2.0000	4.0000	3.6600	47.700	5.9500	5.2300	2.1400	11.670	4.1300	3.7500	-0.	-0.	-0.	-0.
375.00	2.0000	9.0000	4.0600	74.230	3.0900	5.0900	2.7800	52.030	2.5300	2.2900	-0.	-0.	-0.	-0.
376.00	2.0000	3.0000	4.6200	79.340	3.4400	3.1800	2.1000	39.340	3.0300	2.7900	-0.	-0.	-0.	-0.
377.00	2.0000	13.000	3.5300	32.670	4.5300	4.3900	2.7000	36.200	3.0100	2.8000	-0.	-0.	-0.	-0.
378.00	2.0000	4.0000	4.1500	16.190	2.5300	2.3300	1.9600	11.530	1.7000	1.6100	-0.	-0.	-0.	-0.
379.00	2.0000	7.0000	2.9093	39.976	2.1640	2.9747	1.4700	15.730	2.6700	2.7000	-0.	-0.	-0.	-0.
380.00	2.0000	9.0000	5.5500	87.600	3.2400	3.2400	3.5100	50.420	3.0600	2.9600	-0.	-0.	-0.	-0.
381.00	2.0000	9.0000	3.6587	49.159	2.7260	2.6373	2.4200	34.340	2.7200	2.6800	-0.	-0.	-0.	-0.
383.00	2.0000	5.0000	4.5000	93.208	5.4053	5.0987	3.3200	56.880	4.7800	4.6200	-0.	-0.	-0.	-0.
384.00	2.0000	2.0000	3.4067	50.533	6.0173	5.9107	2.2700	27.120	4.1300	4.4100	-0.	-0.	-0.	-0.
385.00	2.0000	3.0000	3.6747	53.333	6.2347	6.1080	2.1800	14.040	5.0200	5.1100	-0.	-0.	-0.	-0.
387.00	2.0000	7.0000	5.0363	134.07	3.9920	3.0573	3.1600	67.330	3.7100	3.5800	-0.	-0.	-0.	-0.
388.00	2.0000	4.0000	6.3533	61.716	1.7293	1.6267	5.0700	67.640	1.4100	1.1800	-0.	-0.	-0.	-0.
389.00	2.0000	-0.	3.6700	80.520	4.9700	4.2100	1.4900	27.170	3.2500	2.8500	-0.	-0.	-0.	-0.
390.00	2.0000	4.0000	4.7450	96.880	5.0093	5.0707	2.8300	56.200	-0.	4.4400	-0.	-0.	-0.	-0.
391.00	2.0000	5.0000	4.9320	80.355	5.0167	5.4253	3.2700	11.520	5.7500	5.6000	-0.	-0.	-0.	-0.
392.00	2.0000	4.0000	3.0560	39.645	5.3053	4.6720	2.0900	25.720	3.2800	3.3600	-0.	-0.	-0.	-0.
393.00	2.0000	2.0000	2.9760	22.943	5.5293	5.2667	1.7000	6.7200	4.1700	4.0100	-0.	-0.	-0.	-0.
394.00	2.0000	3.0000	4.5880	35.253	5.2413	5.0967	3.0100	18.420	3.3900	4.3400	-0.	-0.	-0.	-0.
395.00	2.0000	9.0000	4.8167	61.773	4.4760	4.1253	1.6900	16.330	3.1800	3.2600	-0.	-0.	-0.	-0.
396.00	2.0000	3.0000	4.7547	39.065	5.2653	5.1520	3.3600	11.430	4.2900	4.2500	-0.	-0.	-0.	-0.
397.00	2.0000	3.0000	3.1593	43.429	5.2347	5.2760	1.5400	14.320	3.5400	3.4900	-0.	-0.	-0.	-0.
398.00	2.0000	8.0000	5.0320	70.692	6.0813	5.0027	1.7600	7.2900	5.0500	4.7900	-0.	-0.	-0.	-0.
399.00	2.0000	3.0000	4.6013	56.724	4.6187	4.0167	2.7000	33.430	3.4400	2.8000	-0.	-0.	-0.	-0.
401.00	2.0000	1.0000	4.2293	109.59	3.2947	3.3627	3.3400	64.130	2.3700	2.3500	-0.	-0.	-0.	-0.
402.00	2.0000	9.0000	3.9213	74.729	4.8507	4.3800	1.1700	6.6500	3.2500	3.4800	-0.	-0.	-0.	-0.
403.00	2.0000	9.0000	3.2773	50.917	5.6347	5.3407	1.6900	15.350	4.6200	5.0200	-0.	-0.	-0.	-0.
404.00	2.0000	9.0000	17.288	75.511	4.6500	5.0547	12.890	19.070	3.9800	3.9400	-0.	-0.	-0.	-0.
405.00	2.0000	9.0000	5.6000	139.55	4.2200	4.2000	2.7700	62.920	3.2300	3.2300	-0.	-0.	-0.	-0.
406.00	2.0000	10.000	3.6973	49.743	7.9107	7.4147	.81000	11.590	2.9400	3.2600	-0.	-0.	-0.	-0.
407.00	2.0000	7.0000	4.0467	137.50	1.4053	1.4027	4.5700	67.090	1.5000	1.4600	-0.	-0.	-0.	-0.
408.00	2.0000	3.0000	4.0540	29.504	4.5773	4.4747	3.8500	6.6300	4.0400	4.7700	-0.	-0.	-0.	-0.
410.00	2.0000	9.0000	4.3333	83.799	3.7867	3.6373	2.5700	25.240	3.0800	2.8500	-0.	-0.	-0.	-0.
411.00	2.0000	4.0000	3.1313	41.117	3.6733	3.0333	1.7100	13.970	2.8800	3.0800	-0.	-0.	-0.	-0.
412.00	2.0000	4.0000	3.2253	31.676	7.3053	6.9067	1.8000	13.310	5.6500	5.8900	-0.	-0.	-0.	-0.
413.00	2.0000	3.0000	7.0547	103.36	4.7223	4.5967	3.1200	40.450	2.9400	2.7700	-0.	-0.	-0.	-0.
414.00	2.0000	3.0000	2.9333	24.131	2.6057	2.6653	1.8200	6.7300	3.2200	3.1500	-0.	-0.	-0.	-0.
416.00	2.0000	5.0000	3.5367	51.271	3.4013	3.3067	2.4300	23.090	3.1400	3.0200	-0.	-0.	-0.	-0.
417.00	2.0000	5.0000	5.3300	115.57	4.6973	4.4693	3.9300	86.050	4.5800	4.6600	-0.	-0.	-0.	-0.
418.00	2.0000	4.0000	8.3080	164.40	3.6200	3.4840	3.7400	94.320	3.5900	3.1400	-0.	-0.	-0.	-0.
419.00	2.0000	6.0000	3.5013	51.373	5.3243	5.0587	2.1300	27.490	4.5900	4.4300	-0.	-0.	-0.	-0.
420.00	2.0000	1.0000	3.5043	58.917	5.7600	5.1067	2.8000	21.900	5.8600	4.9700	-0.	-0.	-0.	-0.
421.00	2.0000	10.000	4.6267	113.91	4.0933	4.0987	1.8400	25.130	3.9900	3.9000	-0.	-0.	-0.	-0.
422.00	2.0000	4.0000	3.1243	47.424	5.6093	5.1253	1.5300	6.1100	4.5500	4.3900	-0.	-0.	-0.	-0.
423.00	2.0000	9.0000	4.4227	143.92	3.6333	3.7493	2.7400	97.040	2.2000	2.5000	-0.	-0.	-0.	-0.
424.00	2.0000	3.0000	3.0200	34.336	4.0027	4.1173	1.6600	11.640	3.6000	3.8800	-0.	-0.	-0.	-0.
425.00	2.0000	5.0000	3.2053	34.097	5.5720	5.4653	1.8600	9.3500	5.0200	4.9300	-0.	-0.	-0.	-0.
426.00	2.0000	3.0000	4.5787	50.687	3.1707	3.4080	5.4400	12.250	7.2400	7.7800	-0.	-0.	-0.	-0.
427.00	2.0000	3.0000	4.3333	103.01	2.7920	2.5173	2.0900	9.0900	3.0100	2.7600	-0.	-0.	-0.	-0.
428.00	2.0000	9.0000	3.9467	71.424	5.4520	-0.	1.9200	30.320	3.8200	-0.	-0.	-0.	-0.	-0.
429.00	2.0000	5.0000	4.4033	69.604	5.2987	4.4760	2.6600	37.420	5.1100	4.5700	-0.	-0.	-0.	-0.
430.00	2.0000	5.0000	4.1573	60.092	5.6320	5.3600	2.8500	29.350	3.9700	3.4400	-0.	-0.	-0.	-0.
431.00	2.0000	3.0000	4.4360	57.539	3.1493	-0.	2.7900	39.700	2.9600	-0.	-0.	-0.	-0.	-0.
432.00	2.0000	1.0000	4.6653	107.30	3.6507	3.0453	3.3600	71.430	2.8800	2.5400	-0.	-0.	-0.	-0.
433.00	2.0000	8.0000	4.5627	75.660	2.4347	2.4147	2.0900	32.530	1.9600	1.7300	-0.	-0.	-0.	-0.
434.00	2.0000	9.0000	4.3167	73.911	3.6227	3.6733	1.9700	17.770	2.5300	2.3700	-0.	-0.	-0.	-0.
435.00	2.0000	8.0000	6.5167	160.04	6.5443	6.0613	4.5200	96.190	2.1000	1.6500	-0.	-0.	-0.	-0.
436.00	2.0000	2.0000	2.6427	60.227	4.6053	4.2013	1.2000	31.230	3.1500	2.6400	-0.	-0.	-0.	-0.
437.00	2.0000	6.0000	5.6333	83.325	7.0173	6.1960	3.1900	46.190	5.7300	5.4300	-0.	-0.	-0.	-0.
439.00	2.0000	8.0000	6.0573	47.111	3.6707	3.4320	2.7600	46.230	3.6200	3.2100	-0.	-0.	-0.	-0.
440.00	2.0000	10.000	25.316	91.272	5.0453	4.7533	12.460	17.500	4.3300	3.6800	-0.	-0.	-0.	-0.
441.00	2.0000	14.000	4.3667	50.945	4.4480	4.2307	2.1700	19.160	3.9900	3.5600	-0.	-0.	-0.	-0.
442.00	2.0000	5.0000	3.6750	82.903	6.1573	5.4653	3.8700	44.160	5.3200	4.3300	-0.	-0.	-0.	-0.

70

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
443.00	2.0000	8.0000	4.9680	77.528	5.9027	5.0926	2.5900	37.600	4.5500	4.0000	-0.	-0.	-0.	-0.
444.00	2.0000	12.000	3.7240	66.589	2.8733	2.8027	2.5000	40.900	2.8100	2.3300	-0.	-0.	-0.	-0.
445.00	2.0000	13.000	4.1093	25.221	3.1627	3.2280	2.3900	15.740	3.6400	3.0700	-0.	-0.	-0.	-0.
446.00	2.0000	13.000	5.3840	41.469	3.1413	2.9960	2.9900	29.450	3.2800	2.9900	-0.	-0.	-0.	-0.
447.00	2.0000	13.000	3.2813	35.109	2.1240	2.0853	1.8200	23.260	1.9000	1.7300	-0.	-0.	-0.	-0.
448.00	2.0000	13.000	3.5300	31.505	0.4853	5.6027	1.9700	22.690	5.1600	4.5000	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			4.7255	67.500	4.6528	4.2835	2.0466	32.198	3.5312	3.3998	2.1550	13.835	3.8833	3.4900
ESTIMATE OF STANDARD DEVIATION			2.3666	36.916	1.4352	1.2512	1.5020	27.024	1.0976	1.1439	2.12132E-02	3.6275	.51003	-0.
DEGREES OF FREEDOM			135	135	132	127	133	133	129	126	1	1	2	1
T VALUE			23.287	21.419	37.386	38.736	20.397	13.792	36.674	33.494	143.67	5.3938	13.188	-0.

71

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	HC 72COLD	CO 72COLD	NOX 72COLD	NOXP 72CLD	HC EPA	CO EPA	NOX EPA	NOXP EPA	HC 7MODE	CO 7MODE	NOX 7MODE	NOXP 7MODE
301.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
302.00	3.0000	3.0000	3.7615	33.903	3.9093	3.2720	2.4100	8.9000	3.2600	2.7400	-0.	-0.	-0.	-0.
303.00	3.0000	3.0000	3.5387	32.272	3.2720	3.0760	2.0100	9.0200	3.1500	2.6700	-0.	-0.	-0.	-0.
304.00	3.0000	9.0000	4.2693	30.043	5.0867	4.5533	2.0000	13.790	3.0700	2.9500	-0.	-0.	-0.	-0.
305.00	3.0000	9.0000	4.2413	59.397	.20000	-0.	2.8700	34.940	-0.	-0.	-0.	-0.	-0.	-0.
306.00	3.0000	9.0000	4.2320	46.748	4.2427	4.6267	2.0900	14.370	3.1700	3.5400	-0.	-0.	-0.	-0.
307.00	3.0000	9.0000	4.5640	48.005	5.3453	4.7107	2.4800	16.200	3.5800	3.5000	-0.	-0.	-0.	-0.
308.00	3.0000	9.0000	4.5560	67.072	4.7627	4.5253	2.5300	22.490	3.6800	3.2700	-0.	-0.	-0.	-0.
309.00	3.0000	9.0000	4.0027	32.527	4.5333	4.1680	2.9500	15.130	3.8900	2.6200	-0.	-0.	-0.	-0.
310.00	3.0000	9.0000	3.8960	14.836	4.2360	4.2093	2.4300	7.5800	3.3200	2.7000	-0.	-0.	-0.	-0.
311.00	3.0000	9.0000	4.2480	20.005	6.2973	5.6200	2.8700	10.610	4.9100	4.6700	-0.	-0.	-0.	-0.
312.00	3.0000	9.0000	4.1560	36.599	4.8760	4.3667	2.1700	13.660	3.8100	3.3900	-0.	-0.	-0.	-0.
313.00	3.0000	9.0000	4.0467	34.849	4.8387	4.1733	2.0800	11.280	3.3500	2.8600	-0.	-0.	-0.	-0.
315.00	3.0000	3.0000	3.6533	37.351	3.7587	3.3347	1.9300	14.420	3.1000	2.5200	-0.	-0.	-0.	-0.
316.00	3.0000	3.0000	2.6907	28.644	3.8747	3.2747	1.7400	8.6700	2.9100	2.7800	-0.	-0.	-0.	-0.
317.00	3.0000	3.0000	3.6147	35.307	4.4213	3.9067	2.4200	9.5300	3.0700	3.4600	-0.	-0.	-0.	-0.
318.00	3.0000	3.0000	3.1373	21.587	4.8187	3.7493	2.2200	11.290	3.4100	2.9900	-0.	-0.	-0.	-0.
320.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
321.00	3.0000	3.0000	4.1000	67.780	4.5427	4.0933	3.3300	59.510	3.3500	3.3500	-0.	-0.	-0.	-0.
322.00	3.0000	3.0000	4.7160	57.305	4.2240	3.8467	2.5700	23.690	3.5800	3.0800	-0.	-0.	-0.	-0.
323.00	3.0000	7.0000	1.6387	71.860	4.4627	3.9400	2.3400	37.030	3.8900	3.7000	-0.	-0.	-0.	-0.
325.00	3.0000	7.0000	5.0400	81.495	3.8347	3.4267	3.4500	46.170	3.4600	3.0600	-0.	-0.	-0.	-0.
326.00	3.0000	1.0000	3.6947	46.552	6.7280	5.8373	2.9600	20.870	5.5900	5.0400	-0.	-0.	-0.	-0.
329.00	3.0000	3.0000	3.5967	41.248	4.1613	3.6200	2.7800	24.320	3.3500	2.9900	-0.	-0.	-0.	-0.
330.00	3.0000	9.0000	3.8587	54.936	6.2120	6.0000	2.0700	14.200	5.6700	5.0000	-0.	-0.	-0.	-0.
334.00	3.0000	3.0000	4.5173	61.497	4.5507	4.1360	1.5900	21.760	4.2700	3.9000	-0.	-0.	-0.	-0.
336.00	3.0000	1.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			3.9155	44.375	4.4662	4.1859	2.4287	19.043	3.7148	3.3385	0.	0.	0.	0.
ESTIMATE OF STANDARD DEVIATION			.69077	17.695	1.2275	.78921	.47660	12.983	.74355	.72116	-0.	-0.	-0.	-0.
DEGREES OF FREEDOM			23	23	23	22	23	23	22	22	0	0	0	0
T VALUE			27.769	12.286	17.625	25.436	24.965	7.4122	23.900	22.200	-0.	-0.	-0.	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES M

CAR NO	TEST NO	CAR MAKE	HC 72HOT	CO 72HOT	NOX 72HOT	NOXP 72HOT	HC 75COLD	CO 75COLD	NOX 75COLD	NOXP 75CLD
301.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
302.00	3.0000	3.0000	2.5107	11.736	4.0920	3.3133	3.0485	21.266	4.0135	3.2950
303.00	3.0000	3.0000	2.4453	17.280	3.4000	3.1000	2.9383	22.747	3.2900	3.1253
304.00	3.0000	9.0000	3.2680	21.791	4.7627	4.2707	3.6986	25.339	4.9020	4.3922
305.00	3.0000	9.0000	3.8507	44.441	-0.	-0.	4.0187	50.872	-0.	-0.
306.00	3.0000	9.0000	2.8427	19.923	4.2427	5.0387	3.4401	31.458	4.2427	4.8015
307.00	3.0000	9.0000	3.6513	27.723	5.3973	4.7293	4.0495	36.444	5.3750	4.7213
308.00	3.0000	9.0000	3.1773	28.465	5.2387	4.4920	3.7702	45.324	5.0340	4.4203
309.00	3.0000	9.0000	3.4453	18.521	4.6787	4.3187	3.6736	24.244	4.0162	4.2535
310.00	3.0000	9.0000	3.1840	10.396	4.2280	3.8480	3.4902	12.305	4.2314	4.0034
311.00	3.0000	9.0000	3.3560	15.992	6.0947	5.4520	3.7396	17.718	6.1818	5.5242
312.00	3.0000	9.0000	2.4107	19.927	5.2853	4.0667	3.7312	27.096	5.1093	4.5377
313.00	3.0000	9.0000	3.2147	17.951	4.9307	4.1493	3.5724	25.235	4.0911	4.1597
315.00	3.0000	3.0000	2.5213	17.771	3.7000	3.2013	3.0081	20.190	3.7252	3.2587
316.00	3.0000	3.0000	2.1200	14.537	3.8500	3.3267	2.4514	20.003	3.8040	3.3043
317.00	3.0000	3.0000	2.7400	14.424	4.6293	4.0947	3.1161	23.404	4.5399	4.0138
318.00	3.0000	3.0000	2.4400	11.375	4.5453	3.8046	2.7399	15.766	4.6029	3.7805
320.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
321.00	3.0000	3.0000	4.0000	62.731	4.2107	3.9920	4.0430	60.322	4.3534	4.0350
322.00	3.0000	3.0000	3.2293	30.965	4.5760	3.9467	3.0086	42.361	4.4240	3.9037
323.00	3.0000	7.0000	2.9973	50.917	4.5067	4.0573	2.4131	59.931	4.9077	4.0103
325.00	3.0000	7.0000	3.2533	71.327	3.5440	3.1373	4.3636	75.699	3.6690	3.2017
326.00	3.0000	1.0000	2.6627	24.412	6.7960	5.7600	3.2204	34.792	6.7608	5.6047
329.00	3.0000	3.0000	3.1027	29.896	4.1413	3.7107	3.3159	34.777	4.1499	3.0717
333.00	3.0000	9.0000	3.3393	40.793	6.3800	5.4627	3.5911	46.075	6.3078	5.6937
334.00	3.0000	3.0000	2.4360	22.514	5.0707	4.4293	3.3310	34.279	4.0471	4.3032
335.00	3.0000	3.0000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			3.0866	27.148	4.7125	4.1914	3.4430	34.555	4.0863	4.1890
ESTIMATE OF STANDARD DEVIATION			.50364	16.774	.86453	.75052	.50426	16.404	.64708	.75920
DEGREES OF FREEDOM			23	23	22	22	23	23	22	22
T VALUE			30.024	7.9255	26.142	26.783	33.450	10.273	26.532	20.462

73

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
301.00	1.1000	1866.0	103.57	.47043	2240.2	-0.	187.81	.44459	2271.4	-0.	187.81	.64063	391.93	-0.
302.00	1.1000	1255.0	77.027	.83413	1261.7	-0.	124.65	.25951	1339.9	-0.	139.29	.10397	356.37	-0.
303.00	1.1000	108.00	187.08	1.1962	1278.1	-0.	204.45	.65057	1225.9	-0.	247.50	.31189	334.96	-0.
304.00	1.1000	41.000	106.45	.53950	2766.2	-0.	110.48	.40825	1771.6	-0.	115.85	.48016	364.89	-0.
305.00	1.1000	59.000	128.26	.44165	3365.8	-0.	116.65	.44165	1988.0	-0.	133.43	.89728	343.91	-0.
306.00	1.1000	58.000	92.288	.47751	1969.9	-0.	92.288	.16606	944.37	-0.	143.73	1.0940	229.55	-0.
307.00	1.1000	47.000	100.95	.36700	2843.5	-0.	94.557	.41907	1421.4	-0.	142.10	1.3205	249.77	-0.
308.00	1.1000	93.000	84.476	.28026	3071.7	-0.	129.37	.16689	1615.3	-0.	157.87	.71135	231.79	-0.
309.00	1.1000	66.000	88.179	.30103	2095.0	-0.	84.357	.24366	878.20	-0.	134.35	1.2121	244.98	-0.
310.00	1.1000	43.000	127.36	.52359	3400.8	-0.	120.95	.36198	1830.5	-0.	176.41	1.4109	215.81	-0.
311.00	1.1000	69.000	114.72	.31916	2968.6	-0.	95.564	.23650	1618.0	-0.	132.68	.71302	312.59	-0.
312.00	1.1000	47.000	115.02	.27485	2689.5	-0.	94.763	.23044	1205.9	-0.	157.15	1.5109	188.86	-0.
313.00	1.1000	952.00	181.60	.30574	3547.4	-0.	142.50	.21710	1245.7	-0.	175.06	1.5883	188.13	-0.
314.00	1.1000	1804.0	94.881	.94898	1302.0	-0.	118.90	.51455	941.89	-0.	102.87	.16557	156.91	-0.
315.00	1.1000	5000.0	97.162	.50970	1545.7	-0.	158.27	.40622	1522.4	-0.	183.47	.21598	509.61	-0.
316.00	1.1000	2218.0	100.64	.73407	1426.4	-0.	153.49	.25117	1319.5	-0.	208.07	1.6094	136.84	-0.
317.00	1.1000	2347.0	116.71	1.1839	1621.4	-0.	180.15	.63460	1573.5	-0.	206.84	.63460	304.75	-0.
318.00	1.1000	1576.0	59.163	.43310	710.51	-0.	39.360	.40731	459.85	-0.	57.840	.18525	69.763	-0.
319.00	1.1000	3972.0	94.265	.51650	1331.9	-0.	208.76	.31701	1491.1	-0.	289.36	1.7170	210.22	-0.
320.00	1.1000	769.00	82.443	.77049	1675.0	-0.	131.54	.61657	1790.5	-0.	169.03	.87259	375.44	-0.
321.00	1.1000	3019.0	89.961	.52492	2709.1	-0.	139.01	1.6465	1403.3	-0.	209.82	3.5111	141.20	-0.
322.00	1.1000	10571	105.92	.79460	2694.6	-0.	141.89	.93797	1888.6	-0.	250.61	3.5632	99.964	-0.
323.00	1.1000	1216.0	65.214	.76760	2412.6	-0.	72.812	.37393	2105.5	-0.	75.348	1.1123	161.46	-0.
324.00	1.1000	5069.0	154.17	10.226	2994.1	-0.	198.28	.27491	3884.5	-0.	388.33	7.3192	98.291	-0.
325.00	1.1000	6722.0	188.16	.68383	3160.2	-0.	281.18	1.9581	1973.4	-0.	317.68	5.5637	141.79	-0.
326.00	1.1000	2186.0	56.369	.17298	2306.5	-0.	88.055	.16049	1165.1	-0.	120.01	1.0053	222.09	-0.
327.00	1.1000	6206.0	113.36	.16643	3467.6	-0.	102.57	.16020	976.91	-0.	117.41	.20392	173.76	-0.
328.00	1.1000	2650.0	107.28	.23742	2747.0	-0.	127.17	.52861	1625.1	-0.	135.15	1.3504	243.84	-0.
329.00	1.1000	4796.0	116.73	.49238	2046.7	-0.	126.14	.19812	1490.4	-0.	270.95	3.3453	173.51	-0.
330.00	1.1000	4288.0	79.918	.23640	2035.0	-0.	91.824	.28712	1063.2	-0.	69.360	.17973	291.75	-0.
331.00	1.1000	5201.0	102.63	.63789	1958.1	-0.	158.88	1.0135	1224.2	-0.	227.77	2.1133	170.00	-0.
332.00	1.1000	6555.0	159.63	.27241	3593.7	-0.	302.63	2.8571	1026.5	-0.	298.48	7.6685	146.82	-0.
333.00	1.1000	28085	68.306	.28438	1517.1	-0.	89.522	.64574	636.00	-0.	161.83	1.5731	265.57	-0.
334.00	1.1000	4485.0	85.052	1.1764	2593.1	-0.	75.819	.28685	2040.1	-0.	87.693	.63816	279.51	-0.
335.00	1.1000	2981.0	187.81	.85176	2883.1	-0.	137.81	.53077	822.84	-0.	147.23	1.6892	163.01	-0.
336.00	1.1000	1823.0	147.86	.75566	3081.9	-0.	177.72	1.5883	1200.4	-0.	166.84	6.2114	87.611	-0.
337.00	1.1000	6498.0	270.36	1.3235	2493.5	-0.	274.57	.47521	1310.2	-0.	245.16	2.0391	89.085	-0.
338.00	1.1000	3537.0	197.69	1.7599	2369.6	-0.	246.61	3.9119	647.69	-0.	331.61	7.8620	73.131	-0.
339.00	1.1000	12702	271.35	1.3325	2758.7	-0.	299.75	1.5689	1222.2	-0.	301.17	2.3193	82.092	-0.
340.00	1.1000	4258.0	184.28	.17274	3995.5	-0.	198.42	.40743	1946.3	-0.	168.78	5.2525	85.370	-0.
341.00	1.1000	4528.0	55.349	.16415	3093.1	-0.	63.501	.13960	850.31	-0.	120.94	1.7965	146.60	-0.
342.00	1.1000	6092.0	82.453	.12811	2938.5	-0.	151.07	.51345	2138.7	-0.	146.93	3.1555	149.25	-0.
343.00	1.1000	2562.0	70.407	.72711	2283.5	-0.	103.24	.36403	2113.6	-0.	147.36	3.8140	118.24	-0.
344.00	1.1000	27733	180.11	2.5931	1100.1	-0.	164.74	.62961	967.79	-0.	196.94	5.2709	102.89	-0.
345.00	1.1000	11116	140.03	2.1205	1227.0	-0.	175.27	2.8027	536.11	-0.	2240.4	3.7355	88.056	-0.
346.00	1.1000	6930.0	116.29	.78526	2662.4	-0.	137.10	1.1695	1476.9	-0.	85.932	1.0994	356.84	-0.
347.00	1.1000	2449.0	39.314	.23747	2270.2	-0.	42.037	.12691	1388.3	-0.	85.806	.69059	249.09	-0.
348.00	1.1000	6209.0	76.557	.43603	3354.1	-0.	100.98	.67743	1631.7	-0.	204.05	3.2680	193.54	-0.
349.00	1.1000	7543.0	172.86	2.7275	1771.4	-0.	164.49	1.0365	728.66	-0.	272.98	1.0080	92.968	-0.
350.00	1.1000	6757.0	172.72	.60925	2973.5	-0.	211.62	.58963	1831.6	-0.	308.80	8.3904	71.477	-0.
351.00	1.1000	8568.0	167.43	.59616	3094.4	-0.	234.33	1.1741	2283.9	-0.	245.57	4.6355	134.63	-0.
352.00	1.1000	7377.0	130.20	1.1928	2778.7	-0.	149.47	1.2643	1872.7	-0.	339.27	7.7696	141.04	-0.
353.00	1.1000	8175.0	193.88	.40898	3056.2	-0.	208.02	.22025	1703.7	-0.	217.95	3.1701	47.911	-0.
354.00	1.1000	13399	125.34	.17795	3801.7	-0.	133.54	.15315	1999.4	-0.	335.83	3.3641	292.01	-0.
355.00	1.1000	5912.0	126.71	.92033	2901.6	-0.	128.07	.16515	2058.6	-0.	286.24	8.0182	80.142	-0.
356.00	1.1000	5079.0	59.597	.19638	1621.9	-0.	59.597	.12828	591.04	-0.	239.97	2.0554	176.21	-0.
357.00	1.1000	3776.0	77.684	.41486	2158.1	-0.	164.98	.77389	1600.5	-0.	235.37	5.2416	66.899	-0.
358.00	1.1000	7796.0	205.14	1.2481	2943.1	-0.	300.36	4.1142	447.15	-0.	394.55	8.0658	101.08	-0.
359.00	1.1000	13811	218.28	.79723	2995.2	-0.	176.62	.99527	929.10	-0.	223.86	3.3030	181.53	-0.
360.00	1.1000	13611	207.27	1.4696	2275.6	-0.	189.08	1.0239	838.04	-0.	485.41	6.6345	54.704	-0.
361.00	1.1000	2456.0	134.72	8.56979E-02	2892.2	-0.	159.87	.23498	1833.6	-0.	102.77	1.2223	66.510	-0.
362.00	1.1000	11747	121.47	9.77921E-02	1816.5	-0.	127.00	8.54965E-02	632.40	-0.	205.07	2.0940	120.77	-0.
363.00	1.1000	3597.0	115.10	.30119	1824.9	-0.	217.53	1.1237	1228.9	-0.	256.84	6.5782	99.136	-0.
364.00	1.1000	4507.0	173.34	1.0570	2643.8	-0.	209.30	1.6127	1703.4	-0.	230.17	1.1581	118.33	-0.
365.00	1.1000	4198.0	146.07	.54491	2403.6	-0.	157.06	.19575	1801.6	-0.	187.42	2.2831	146.42	-0.
366.00	1.1000	6716.0	130.35	.24319	2193.3	-0.	134.52	.12371	1110.1	-0.	215.88	1.0183	255.21	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
367.00	1.1000	4179.0	155.23	.70905	3193.4	-0.	149.31	1.1263	1800.1	-0.	230.28	6.5690	83.309	-0.
368.00	1.1000	5992.0	145.56	1.3553	2918.4	-0.	149.31	1.2733	1082.9	-0.	176.91	3.9666	98.458	-0.
369.00	1.1000	5047.0	377.62	5.5652	959.16	-0.	379.06	4.7748	766.68	-0.	299.09	8.1450	91.334	-0.
370.00	1.1000	2358.0	176.91	2.4593	1755.2	-0.	217.18	1.8125	1550.2	-0.	190.76	1.6593	183.93	-0.
371.00	1.1000	8510.0	107.35	.24835	2740.4	-0.	131.34	.63711	1107.2	-0.	202.53	4.0641	108.36	-0.
372.00	1.1000	596.00	120.21	.62085	3503.8	-0.	113.15	9.78950E-02	2804.2	-0.	161.37	.82173	561.62	-0.
373.00	1.1000	3801.0	117.39	1.0277	2707.7	-0.	174.20	1.9549	1707.9	-0.	138.62	2.7457	126.93	-0.
374.00	1.1000	6781.0	144.20	.15462	3521.7	-0.	232.05	.38357	2690.7	-0.	170.97	1.1872	216.87	-0.
375.00	1.1000	4682.0	245.33	2.9841	2184.1	-0.	347.28	4.8459	850.82	-0.	451.21	11.958	80.048	-0.
376.00	1.1000	12635	172.90	1.1105	3595.2	-0.	184.25	.28453	2686.8	-0.	600.44	1.6965	144.61	-0.
377.00	1.1000	3194.0	194.49	.91118	2115.3	-0.	223.06	1.2271	526.57	-0.	273.43	1.7085	99.134	-0.
378.00	1.1000	12857	168.81	.24025	3688.8	-0.	282.45	2.1170	1228.0	-0.	258.10	7.1129	86.791	-0.
379.00	1.1000	12977	82.477	.14140	2619.5	-0.	138.17	.70133	910.48	-0.	601.30	4.0494	77.297	-0.
380.00	1.1000	10722	215.58	.83393	3225.2	-0.	344.24	2.7157	1448.2	-0.	503.11	8.7820	71.133	-0.
381.00	1.1000	7816.0	146.26	.19033	3366.0	-0.	263.32	2.2552	1264.7	-0.	244.59	5.5940	105.18	-0.
382.00	1.1000	11302	134.37	.17359	3445.8	-0.	212.89	.37707	2102.9	-0.	237.40	3.3471	218.81	-0.
383.00	1.1000	7005.0	45.675	.12300	2436.2	-0.	80.537	.12300	1571.4	-0.	91.741	.31140	194.24	-0.
384.00	1.1000	10614	115.28	.49755	2971.2	-0.	154.74	.69556	2450.2	-0.	101.26	.36842	171.70	-0.
385.00	1.1000	3054.0	169.56	1.9507	2653.9	-0.	168.15	1.3332	1473.0	-0.	277.96	8.0424	78.755	-0.
386.0	1.1000	7686.0	98.834	.65739	2305.9	-0.	130.79	.17136	2150.0	-0.	144.75	.15899	278.70	-0.
387	1.1000	5541.0	110.99	1.4179	1847.0	-0.	153.75	1.1221	1774.3	-0.	278.24	8.8224	72.101	-0.
388	1.1000	11615	213.83	2.3277	1120.0	-0.	261.09	2.9006	526.40	-0.	308.77	7.2155	113.93	-0.
389	1.1000	8848.0	209.39	.21422	3224.8	-0.	372.34	2.3435	1363.1	-0.	334.07	8.5999	123.99	-0.
390.0	1.1000	8005.0	76.115	.21233	3194.0	-0.	136.39	.71004	1989.1	-0.	129.34	1.9207	154.32	-0.
391.00	1.1000	6843.0	77.864	.14163	2694.2	-0.	134.58	.75438	2264.3	-0.	168.06	2.0998	155.13	-0.
392.00	1.1000	11649	130.56	.57198	3455.8	-0.	195.62	1.2058	1738.6	-0.	281.69	3.9219	159.62	-0.
393.00	1.1000	9521.0	92.046	.20406	2618.5	-0.	143.56	.34965	1609.1	-0.	258.10	4.5357	80.656	-0.
394.00	1.1000	4804.0	92.867	.24690	2194.2	-0.	101.26	.72809	1149.6	-0.	248.91	1.3110	287.61	-0.
395.00	1.1000	8744.0	130.12	.78098	2590.5	-0.	107.51	.27054	1214.5	-0.	107.51	.20039	377.15	-0.
396.00	1.1000	12272	162.02	.37328	2227.7	-0.	225.66	.15947	1719.8	-0.	368.39	1.0752	289.23	-0.
397.00	1.1000	12019	122.49	.48213	3792.6	-0.	139.41	.20553	3156.0	-0.	109.83	.64780	128.65	-0.
398.00	1.1000	12962	179.99	.91268	3102.7	-0.	224.16	.23658	3224.7	-0.	112.31	.40989	187.78	-0.
399.00	1.1000	6397.0	110.91	.46111	2286.5	-0.	124.93	.15472	1488.2	-0.	137.59	.63915	156.23	-0.
400.00	1.1000	5214.0	64.785	.11654	2945.0	-0.	68.947	.68140	1290.7	-0.	57.855	.63487	125.31	-0.
401.00	1.1000	6016.0	158.04	.17777	2756.1	-0.	204.67	.37899	1369.0	-0.	287.62	3.6362	147.88	-0.
402.00	1.1000	4382.0	83.585	.18412	1944.6	-0.	97.643	.27791	1347.7	-0.	215.77	6.8653	153.58	-0.
403.00	1.1000	6275.0	100.61	.23480	2365.8	-0.	128.90	.17229	1866.3	-0.	164.46	2.9365	181.03	-0.
404.00	1.1000	16061	60.128	.15173	1978.2	-0.	57.317	.17630	869.16	-0.	152.32	2.5548	209.22	-0.
405.00	1.1000	13775	133.33	.80878	2570.2	-0.	147.72	.55094	1614.4	-0.	212.91	4.2638	142.63	-0.
406.00	1.1000	8507.0	123.04	.47668	2423.5	-0.	137.20	.41862	1531.6	-0.	123.04	.86216	326.64	-0.
407.00	1.1000	9286.0	111.57	2.3251	732.12	-0.	203.96	3.6273	186.21	-0.	309.66	7.5034	77.702	-0.
408.00	1.1000	6467.0	69.049	.15329	1342.0	-0.	129.15	.13473	1685.0	-0.	398.64	.48260	188.33	-0.
409.00	1.1000	10528	80.031	.31015	2400.6	-0.	122.56	.93757	1465.3	-0.	139.12	2.8163	114.47	-0.
410.00	1.1000	32322	92.903	.15961	2242.5	-0.	151.62	.28476	1553.9	-0.	192.97	5.8327	127.89	-0.
411.00	1.1000	22543	152.22	1.0043	1967.7	1908.0	220.67	.77759	1631.6	1545.1	192.04	1.2381	222.25	223.50
412.00	1.1000	6467.0	71.531	.14800	3140.6	-0.	111.22	.19798	2235.0	-0.	164.12	3.9124	96.973	-0.
413.00	1.1000	14918	212.23	.81121	2862.4	-0.	308.37	1.6974	1722.1	-0.	388.35	7.7668	75.256	-0.
414.00	1.1000	15893	171.19	1.5887	2111.1	2049.7	155.52	.31114	1925.8	1825.4	191.19	.13533	413.61	349.59
415.00	1.1000	8400.0	73.362	.20425	2184.8	2173.0	106.92	.21053	1262.5	1158.0	125.18	1.0885	252.49	192.00
416.00	1.1000	7218.0	137.33	.15501	3282.4	3139.4	175.14	.39042	1774.2	1686.1	266.42	6.5565	82.506	38.573
417.00	1.1000	9510.0	136.53	.23490	2602.8	2415.9	182.33	.36152	1955.5	1764.3	273.64	3.7141	122.09	64.229
418.00	1.1000	31036	202.75	2.4871	2339.6	2242.5	208.53	1.8602	1588.6	1430.9	225.92	7.3933	111.33	89.838
419.00	1.1000	14661	142.81	.99384	2530.6	2447.1	145.71	.19107	2128.2	2011.7	239.22	4.5113	97.777	51.407
420.00	1.1000	4980.0	68.012	.28966	3647.6	3552.6	86.583	.22710	1863.3	1797.7	116.72	1.4559	141.86	83.443
421.00	1.1000	6554.0	125.56	.36152	2714.5	2519.4	154.51	.36152	1918.8	1797.7	242.34	5.9713	107.90	64.229
422.00	1.1000	9814.0	90.602	.96962	2723.2	2631.9	109.20	.69864	1519.0	1407.9	171.17	4.1470	98.476	64.229
423.00	1.1000	22127	104.42	1.8779	2007.8	-0.	119.29	1.4556	1280.0	-0.	177.70	6.3592	154.79	-0.
424.00	1.1000	3172.0	60.428	.19466	2410.9	2178.7	83.090	.13762	1608.1	1459.5	134.44	.31003	325.94	261.45
425.00	1.1000	1877.0	85.153	.15269	3297.8	3224.9	121.04	.18980	2099.5	2006.3	157.17	1.5370	150.58	115.40
426.00	1.1000	6961.0	101.07	.25180	2549.0	2560.5	124.88	.15007	1344.8	1303.9	155.86	.10599	311.02	242.49
427.00	1.1000	10391	267.53	2.1501	1445.4	1332.9	292.67	.22265	1574.4	1436.6	591.45	1.9897	188.36	102.62
428.00	1.1000	11480	170.25	.60449	2660.7	2615.3	179.06	.75166	1574.1	1481.4	291.87	7.6261	91.279	51.563
429.00	1.1000	12923	151.23	1.1310	3127.0	3009.3	142.47	.14888	2650.2	2408.6	168.79	1.5040	120.03	84.035
430.00	1.1000	28497	184.98	.29667	3492.5	3479.5	211.11	.25267	2087.8	1800.5	406.76	8.2678	74.800	25.840
431.00	1.1000	5720.0	182.28	2.0100	1786.6	1713.0	202.93	.86877	1756.1	1674.0	240.00	1.2960	210.56	146.74
432.00	1.1000	11688	147.39	.31069	2631.3	2538.2	156.10	.31069	1065.2	965.19	154.65	.34248	153.16	96.524

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 1A

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
433.00	1.1000	13128	232.96	1.7289	2603.5	2549.8	250.64	1.6290	1308.8	1189.3	240.32	3.5595	95.530	64.337
434.00	1.1000	7624.0	200.72	1.5889	1669.0	1540.8	178.85	.69519	796.34	681.00	304.00	7.5822	130.67	51.632
435.00	1.1000	11979	317.93	3.1181	1767.8	1726.5	375.09	6.7145	280.04	382.35	390.23	5.9699	73.826	32.271
436.00	1.1030	4670.0	82.744	.36537	2494.5	2461.8	153.67	1.5284	1260.5	1175.8	117.36	1.7190	117.57	80.401
437.00	1.1000	6730.0	154.66	.80781	2803.3	2697.7	91.683	.19871	830.95	666.86	228.60	6.9313	90.287	38.638
438.00	1.1000	15918	241.35	4.7433	726.20	613.22	197.95	.28128	1195.8	1026.4	466.86	5.8698	136.35	77.377
439.00	1.1000	8894.0	163.30	1.3855	2157.9	-0.	186.43	1.6395	889.23	-0.	170.52	4.0858	143.46	-0.
440.00	1.1000	24942	84.574	.28864	2617.0	-0.	106.29	.28225	1707.5	-0.	74.469	.37872	401.99	-0.
441.00	1.1000	14206	147.07	1.1144	3058.7	-0.	106.29	.22265	1136.4	-0.	135.39	.24780	97.572	-0.
442.00	1.1000	16787	93.106	.77470	2715.3	2642.2	113.64	.61992	1611.5	1502.6	256.12	4.3620	74.547	32.098
443.00	1.1000	13774	145.06	1.0401	2307.3	2299.1	177.51	.72897	1957.4	1779.1	294.19	7.4987	74.621	32.403
444.00	1.1000	15506	204.47	3.7770	1413.0	1321.5	210.30	2.9470	598.84	501.54	208.85	3.7972	115.90	51.632
445.00	1.1000	5369.0	127.04	.21663	1897.2	1739.0	282.72	1.4631	1270.3	1103.9	590.92	4.9847	50.927	19.384
446.00	1.1000	3773.0	197.72	.18446	2879.4	2234.2	353.62	2.0376	1907.2	1863.4	424.24	5.2640	112.33	66.004
447.00	1.1000	7206.0	127.31	.76518	3078.2	2956.2	104.19	.39187	663.79	587.68	166.54	4.2881	113.35	64.424
448.00	1.1000	9261.0	166.28	.13498	4281.2	4134.8	296.00	2.4748	2006.0	1909.0	487.44	8.4660	133.41	113.94
449.00	1.1000	27162	147.16	.51410	4090.7	3991.0	157.31	.51410	1697.3	1575.3	217.16	2.8959	124.31	95.692
450.00	1.1000	7007.0	141.72	.12275	4574.6	4358.3	254.95	1.4080	2878.4	2820.4	284.37	3.5284	146.53	103.36
ESTIMATE OF MEAN			135.19	.87259	2536.8	2499.9	166.95	.88962	1515.6	1462.5	239.67	3.3433	168.23	96.215
ESTIMATE OF STANDARD DEVIATION			55.801	1.1568	740.26	814.56	70.882	1.0476	595.89	534.26	198.76	2.7270	95.949	75.138
DEGREES OF FREEDOM			149	149	149	33	149	149	149	33	149	149	149	33
T VALUE			29.672	9.2383	41.971	17.896	28.847	10.400	31.150	15.962	14.768	15.015	21.474	7.4665

76

TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
301.00	1.1000	1866.0	103.57	.47043	2240.2	-0.	187.81	.44459	2271.4	-0.	187.81	.64063	391.93	-0.
301.00	1.2000	1866.0	84.572	.39271	1815.8	-0.	146.30	.34169	1621.7	-0.	170.67	1.0684	128.31	-0.
302.00	1.1000	1255.0	77.027	.83413	1261.7	-0.	124.65	.25951	1339.9	-0.	139.29	.10397	356.37	-0.
302.00	1.2000	1255.0	99.738	.70461	1185.8	-0.	149.06	.25498	1169.2	-0.	175.94	9.84797E-02	338.84	-0.
303.00	1.1000	108.00	187.08	1.1962	1278.1	-0.	204.45	.65057	1225.9	-0.	247.50	.31189	334.94	-0.
303.00	1.2000	108.00	117.21	1.5158	1175.5	-0.	133.06	.54494	1233.8	-0.	147.63	.11215	323.02	-0.
304.00	1.1000	41.000	106.45	.53950	2766.2	-0.	110.48	.40825	1771.6	-0.	115.85	.48016	364.89	-0.
304.00	1.2000	41.000	113.44	.54511	2373.5	-0.	100.59	.36322	1419.2	-0.	128.91	1.9126	229.81	-0.
305.00	1.1000	59.000	125.26	.44165	3365.8	-0.	116.65	.44165	1988.0	-0.	133.43	.89728	343.91	-0.
305.00	1.2000	59.000	140.94	.62025	2704.0	-0.	132.88	.63098	1459.8	-0.	155.74	4.9740	157.22	-0.
306.00	1.1000	58.000	92.288	.47751	1969.9	-0.	92.288	.16606	944.37	-0.	143.73	1.0940	229.55	-0.
306.00	1.2000	58.000	120.35	.22361	3250.9	-0.	98.526	.14209	1852.2	-0.	119.06	1.6432	236.67	-0.
307.00	1.1000	47.000	100.95	.36700	2843.5	-0.	94.557	.41907	1421.4	-0.	142.10	1.3205	249.77	-0.
307.00	1.2000	47.000	110.10	.55892	2694.6	-0.	59.655	.39583	1296.8	-0.	116.45	1.6128	221.21	-0.
308.00	1.1000	93.000	84.476	.28026	3071.7	-0.	129.37	.16689	1615.3	-0.	157.87	.71135	231.79	-0.
308.00	1.2000	93.000	137.63	.39583	3189.8	-0.	114.55	.30603	1619.5	-0.	127.36	.94468	289.23	-0.
309.00	1.1000	66.000	88.179	.30103	2095.0	-0.	64.357	.24366	878.20	-0.	134.35	1.2121	244.98	-0.
309.00	1.2000	66.000	127.54	.29464	2857.2	-0.	95.564	.32668	1163.0	-0.	126.25	1.3287	240.32	-0.
310.00	1.1000	43.000	127.36	.52359	3400.6	-0.	120.95	.36198	1830.5	-0.	176.41	1.4109	215.81	-0.
310.00	1.2000	43.000	125.46	.49497	2492.3	-0.	96.181	.40368	1109.9	-0.	128.13	1.0746	235.39	-0.
311.00	1.1000	69.000	114.72	.31916	2968.6	-0.	95.564	.23650	1618.0	-0.	132.68	.71302	312.59	-0.
311.00	1.2000	69.000	159.69	.45139	3656.9	-0.	129.55	.25732	1752.5	-0.	178.15	2.0376	201.74	-0.
312.00	1.1000	47.000	115.02	.27485	2689.5	-0.	94.763	.23044	1205.9	-0.	157.15	1.5109	188.86	-0.
312.00	1.2000	47.000	126.43	.34478	3079.3	-0.	84.238	.20495	1238.7	-0.	129.00	1.7375	224.53	-0.
313.00	1.1000	952.00	161.60	.30574	3547.4	-0.	142.50	.21710	1245.7	-0.	175.06	1.5883	188.13	-0.
313.00	1.2000	952.00	176.87	.45526	3404.4	-0.	144.21	.29402	1167.7	-0.	153.33	1.0312	254.14	-0.
314.00	1.1000	1804.0	94.381	.94398	1302.0	-0.	118.90	.51455	941.89	-0.	102.87	.16557	156.91	-0.
314.00	1.2000	1804.0	93.416	.85465	1606.3	-0.	153.59	.51940	1317.6	-0.	203.64	.55226	236.82	-0.
315.00	1.1000	5000.0	97.162	.50970	1545.7	-0.	158.27	.40622	1522.4	-0.	183.47	.21598	509.61	-0.
315.00	1.2000	5000.0	90.283	.56742	1514.0	-0.	132.00	.29407	1298.8	-0.	223.36	1.3622	203.47	-0.
316.00	1.1000	2218.0	100.64	.73407	[illegible]	-0.	153.49	.25117	1319.5	-0.	208.07	1.6094	136.84	-0.
316.00	1.2000	2218.0	83.514	.24535	1161.4	-0.	110.90	.17090	1029.9	-0.	227.15	1.2940	155.80	-0.
317.00	1.1000	2347.0	116.71	1.1839	1621.4	-0.	180.15	.63460	1573.5	-0.	206.84	.63460	304.75	-0.
317.00	1.2000	2347.0	101.39	.96500	1651.4	-0.	157.63	.37764	1576.1	-0.	207.72	.69533	291.44	-0.
318.00	1.1000	1576.0	54.163	.43510	710.51	-0.	59.360	.40731	459.85	-0.	57.840	.18525	69.763	-0.
318.00	1.2000	1576.0	74.535	.61359	1434.5	-0.	109.07	.19063	1425.5	-0.	163.89	.59358	292.66	-0.
319.00	1.1000	3972.0	94.265	.51650	1351.9	-0.	208.76	.31701	1491.1	-0.	289.36	1.7170	210.22	-0.
319.00	1.2000	3972.0	80.537	.64034	1513.8	-0.	232.36	.80771	1398.1	-0.	280.07	1.8449	247.15	-0.
320.00	1.1000	769.00	82.443	.77049	1675.0	-0.	131.54	.61657	1790.5	-0.	169.03	.87259	375.44	-0.
320.00	1.2000	769.00	94.070	.97391	1615.3	-0.	127.17	.46795	1748.2	-0.	152.49	.21140	363.65	-0.
321.00	1.1000	3018.0	89.761	.52492	2709.1	-0.	139.01	1.6465	1403.5	-0.	209.62	3.5111	141.20	-0.
321.00	1.2000	3018.0	67.367	.26732	2563.2	-0.	93.894	1.2224	1075.0	-0.	184.99	2.2337	231.07	-0.
322.00	1.1000	10571	105.92	.79460	2694.6	-0.	141.89	.93797	1888.6	-0.	250.61	3.5632	99.964	-0.
322.00	1.2000	10571	114.40	1.2467	2432.5	-0.	144.21	.92157	1858.6	-0.	149.25	2.6435	192.61	-0.
323.00	1.1000	1216.0	65.214	.76760	2412.6	-0.	72.812	.27393	2105.5	-0.	75.348	1.1123	161.46	-0.
323.00	1.2000	1216.0	69.985	.99131	-0.	-0.	66.201	.14802	-0.	-0.	118.22	3.1063	-0.	-0.
324.00	1.1000	5009.0	154.17	10.226	2994.1	-0.	198.28	[illegible]	3884.5	-0.	388.33	7.3192	98.291	-0.
324.00	1.2000	5009.0	183.95	.18591	3818.0	-0.	261.42	1.4255	2739.0	-0.	380.10	5.7130	110.46	-0.
325.00	1.1000	6722.0	168.16	.68363	3160.2	-0.	281.18	1.9581	1973.4	-0.	317.88	5.5637	141.79	-0.
325.00	1.2000	6722.0	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
326.00	1.1000	2186.0	56.369	.17298	2306.5	-0.	88.055	.16049	1165.1	-0.	120.01	1.0053	222.09	-0.
326.00	1.2000	2186.0	63.415	.12343	3546.7	-0.	88.578	.12343	1727.5	-0.	96.160	.44124	120.11	-0.
327.00	1.1000	5206.0	113.36	.18643	3407.6	-0.	102.57	.16020	970.91	-0.	117.41	.20392	173.76	-0.
327.00	1.2000	[illegible]	120.69	.37037	3552.0	-0.	151.08	.97016	1031.1	-0.	118.59	.28198	119.37	-0.
328.00	1.1000	2650.0	107.28	.23742	2747.0	-0.	127.17	.52861	1625.1	-0.	135.15	1.3504	243.84	-0.
328.00	1.2000	2650.0	103.92	.27316	2735.6	-0.	121.46	.36860	1671.5	-0.	128.23	1.2507	212.80	-0.
329.00	1.1000	4796.0	110.73	.49238	2046.7	-0.	126.14	.19512	1490.4	-0.	270.95	3.3453	173.51	-0.
329.00	1.2000	4796.0	91.020	.38762	2048.7	-0.	117.73	.16720	1377.6	-0.	272.92	1.8514	228.92	-0.
330.00	1.1000	[illegible]	74.918	.23040	2035.0	-0.	91.824	.26712	1063.2	-0.	69.360	.17973	241.75	-0.
330.00	1.2000	[illegible]	131.52	.65596	2608.4	-0.	162.96	.65595	1833.4	-0.	128.41	.35304	373.99	-0.
331.00	1.1000	5201.0	102.63	.63788	1956.1	-0.	158.88	1.0135	1224.2	-0.	227.77	2.1133	170.00	-0.
331.00	1.2000	5201.0	88.428	.54989	1837.3	-0.	115.37	.52370	1262.6	-0.	201.31	1.5374	246.26	-0.
332.00	1.1000	6555.0	159.63	.27241	3503.7	-0.	302.63	2.6571	1026.5	-0.	298.48	7.6685	146.82	-0.
332.00	1.2000	6555.0	139.75	.30435	2554.4	-0.	203.66	1.9326	641.36	-0.	195.46	8.8113	61.388	-0.
333.00	1.1000	28085	66.306	.28438	1517.1	-0.	89.522	.64574	636.00	-0.	161.83	1.5731	265.57	-0.
333.00	1.2000	26065	113.15	.71729	2389.7	-0.	121.18	.56968	1167.3	-0.	150.62	1.4129	208.65	-0.

77

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	[redacted] D3	NOXP D3
334.00	1.1000	4485.0	85.052	1.1764	2593.1	-0.	75.819	.28685	2040.1	-0.	87.693	.63816	279.51	-0.
334.00	1.2000	4485.0	110.13	1.1927	2471.1	-0.	98.063	.30470	1596.0	-0.	83.358	.45856	112.14	-0.
335.00	1.1000	2981.0	187.81	.85176	2883.1	-0.	137.81	.53077	822.84	-0.	147.23	1.6892	163.01	-0.
335.00	1.2000	2981.0	193.21	.45721	4188.1	-0.	171.65	.39291	1675.4	-0.	181.07	3.3694	141.94	-0.
336.00	1.1000	1823.0	147.86	.75566	3081.9	-0.	177.72	1.5883	1200.4	-0.	166.84	6.2114	87.611	-0.
336.00	1.2000	1823.0	176.28	.76026	3359.0	-0.	234.25	2.4320	1093.2	-0.	297.07	8.7433	58.320	-0.
337.00	1.1000	6498.0	270.36	1.3235	2493.5	-0.	274.57	.47521	1310.2	-0.	245.16	2.0391	89.085	-0.
337.00	1.2000	6498.0	132.54	1.2919	2565.5	-0.	207.88	.88731	1355.4	-0.	174.26	4.0132	111.60	-0.
338.00	1.1000	3537.0	197.69	1.7599	2369.6	-0.	246.61	3.9119	647.69	-0.	331.61	7.8620	73.131	-0.
338.00	1.2000	3537.0	138.45	1.3908	2440.0	-0.	174.36	4.0150	486.93	-0.	269.54	7.8529	76.571	-0.
339.00	1.1000	12702	271.35	1.3325	2758.7	-0.	299.75	1.5689	1222.2	-0.	301.17	2.3193	82.092	-0.
339.00	1.2000	12702	125.89	1.6976	2356.1	-0.	136.87	1.2745	917.65	-0.	140.95	1.6216	75.503	-0.
340.00	1.1000	4258.0	184.28	.17274	3995.5	-0.	198.42	.40743	1946.3	-0.	168.78	5.2525	85.370	-0.
340.00	1.2000	4258.0	122.50	.14676	4411.4	-0.	148.75	.27135	2225.6	-0.	101.87	3.2350	93.761	-0.
341.00	1.1000	4528.0	55.349	.16415	3093.1	-0.	63.501	.13960	850.31	-0.	120.94	1.7965	146.60	-0.
341.00	1.2000	4528.0	66.707	.36621	3096.7	-0.	80.432	.14059	928.57	-0.	155.20	2.4333	108.36	-0.
342.00	1.1000	6092.0	82.453	.12811	2938.5	-0.	151.07	.51345	2138.7	-0.	146.93	3.1555	149.25	-0.
342.00	1.2000	6092.0	61.960	.12110	3076.7	-0.	120.59	.15169	2421.6	-0.	154.99	4.1326	144.34	-0.
343.00	1.1000	2562.0	70.407	.72711	2283.5	-0.	103.24	.30403	2113.6	-0.	147.36	3.8140	138.24	-0.
343.00	1.2000	2562.0	44.243	.51067	2174.8	-0.	84.808	.24144	2191.9	-0.	171.09	4.8318	145.90	-0.
344.00	1.1000	27733	180.11	2.5931	1100.1	-0.	164.74	.62961	967.79	-0.	196.94	5.2709	102.89	-0.
344.00	1.2000	27733	171.59	3.6448	1475.9	-0.	166.05	1.5087	1499.0	-0.	191.03	6.3068	123.04	-0.
345.00	1.1000	11116	140.03	2.1205	1227.0	-0.	175.27	2.8027	536.11	-0.	2240.4	3.7355	88.056	-0.
345.00	1.2000	11116	125.89	2.8918	1141.0	-0.	152.01	3.4864	195.11	-0.	178.26	2.2084	30.331	-0.
346.00	1.1000	6930.0	116.29	.78526	2662.4	-0.	137.10	1.1695	1476.9	-0.	85.932	1.0994	356.84	-0.
346.00	1.2000	6930.0	131.57	1.1147	2635.7	-0.	131.57	.73287	1564.9	-0.	72.815	.44619	673.21	-0.
347.00	1.1000	2449.0	39.314	.23747	2270.2	-0.	42.037	.12691	1388.3	-0.	85.806	.69059	249.09	-0.
347.00	1.2000	2449.0	54.229	.49928	1944.0	-0.	54.229	.17091	1223.0	-0.	143.63	2.4907	154.13	-0.
348.00	1.1000	6209.0	76.557	.43603	3354.1	-0.	100.98	.67743	1631.7	-0.	204.05	3.2680	193.54	-0.
348.00	1.2000	6209.0	76.336	.41737	3028.5	-0.	104.76	.82597	1742.0	-0.	239.58	3.9678	136.01	-0.
349.00	1.1000	7543.0	172.86	2.7275	1771.4	-0.	164.49	1.0365	728.66	-0.	272.98	1.0088	92.968	-0.
349.00	1.2000	7543.0	150.41	3.1747	2112.4	-0.	151.78	1.8319	1269.5	-0.	155.91	.95470	91.334	-0.
350.00	1.1000	6757.0	172.72	.60925	2973.5	-0.	211.62	.58963	1831.6	-0.	308.80	8.3904	71.477	-0.
350.00	1.2000	6757.0	125.25	.39367	2641.9	-0.	114.23	.24749	1018.1	-0.	236.79	6.8258	61.849	-0.
351.00	1.1000	8568.0	167.43	.59616	3094.4	-0.	234.33	1.1741	2283.9	-0.	245.57	4.6355	134.63	-0.
351.00	1.2000	8568.0	133.15	.74146	2776.9	-0.	193.49	1.4995	1665.5	-0.	170.09	3.9329	113.13	-0.
352.00	1.1000	7377.0	130.20	1.1928	2778.7	-0.	149.47	1.2643	1872.7	-0.	339.27	7.7696	141.04	-0.
352.00	1.2000	7377.0	128.20	.59544	2849.4	-0.	151.74	.90212	1505.3	-0.	129.58	2.0815	265.21	-0.
353.00	1.1000	8175.0	193.88	.40898	3056.2	-0.	208.02	.22025	1703.7	-0.	217.95	3.1701	47.911	-0.
353.00	1.2000	8175.0	175.13	.32699	3714.1	-0.	183.50	.19566	2538.1	-0.	189.08	2.2657	144.34	-0.
354.00	1.1000	13399	125.34	.17795	3801.7	-0.	133.54	.15315	1999.4	-0.	335.83	3.3641	292.01	-0.
354.00	1.2000	13399	81.974	.20260	2172.2	-0.	73.651	.26511	824.97	-0.	211.00	2.2011	131.36	-0.
355.00	1.1000	5912.0	126.71	.92033	2901.6	-0.	128.07	.16515	2058.6	-0.	286.24	8.0182	80.142	-0.
355.00	1.2000	5912.0	126.44	.61224	3044.7	-0.	96.242	.16534	1576.2	-0.	190.20	4.4074	102.04	-0.
356.00	1.1000	5079.0	59.597	.19638	1621.9	-0.	59.597	.12828	591.04	-0.	239.97	2.0554	176.21	-0.
356.00	1.2000	5079.0	84.932	.23984	1846.9	-0.	113.57	.15284	1578.8	-0.	290.35	4.6834	143.63	-0.
357.00	1.1000	3776.0	77.684	.41486	2158.1	-0.	164.98	.77389	1600.5	-0.	235.37	5.2416	66.899	-0.
357.00	1.2000	3776.0	74.499	.21902	2407.6	-0.	162.62	1.3205	1393.7	-0.	165.40	2.9784	60.978	-0.
358.00	1.1000	7796.0	205.14	1.2481	2943.1	-0.	300.36	4.1142	447.15	-0.	394.55	8.0658	101.08	-0.
358.00	1.2000	7796.0	174.36	1.2401	2735.9	-0.	184.08	2.6119	555.17	-0.	150.85	3.0104	52.007	-0.
359.00	1.1000	13811	218.28	.79723	2995.2	-0.	176.62	.99527	929.10	-0.	223.86	3.3030	181.53	-0.
359.00	1.2000	13811	206.30	.50238	3102.1	-0.	147.28	.67779	764.55	-0.	151.47	1.6090	106.45	-0.
360.00	1.1000	13611	207.27	1.4696	2275.6	-0.	189.08	1.0239	638.04	-0.	465.41	6.6345	54.704	-0.
360.00	1.2000	13611	135.51	1.7103	1516.9	-0.	142.45	1.7945	717.38	-0.	180.11	3.6021	111.33	-0.
361.00	1.1000	2456.0	134.72	8.56979E-02	2892.2	-0.	159.87	.23498	1633.6	-0.	102.77	1.2223	66.510	-0.
361.00	1.2000	2456.0	145.64	8.50965E-02	3921.3	-0.	189.63	.15266	3018.9	-0.	138.81	.65048	125.58	-0.
362.00	1.1000	11747	121.47	9.77921E-02	1816.5	-0.	127.00	8.54965E-02	632.40	-0.	205.07	2.0940	120.77	-0.
362.00	1.2000	11747	52.866	.14612	1643.9	-0.	69.246	.27642	786.39	-0.	370.79	8.8428	52.191	-0.
363.00	1.1000	3597.0	115.10	.30119	1824.9	-0.	217.53	1.1237	1228.9	-0.	256.84	6.5782	99.136	-0.
363.00	1.2000	3597.0	88.883	.27590	1830.4	-0.	148.50	.18069	1442.1	-0.	324.23	8.6044	77.057	-0.
364.00	1.1000	4507.0	173.34	1.0570	2643.8	-0.	209.30	1.6127	1703.4	-0.	230.17	1.1581	118.33	-0.
364.00	1.2000	4507.0	131.41	1.2602	1569.0	-0.	103.77	.50111	1184.9	-0.	117.57	.33886	253.59	-0.
365.00	1.1000	4198.0	146.07	.54491	2403.6	-0.	157.06	.19575	1801.6	-0.	187.42	2.2831	146.42	-0.
365.00	1.2000	4198.0	105.37	.37355	2184.1	-0.	174.11	.89635	1380.8	-0.	183.81	3.5445	132.14	-0.
366.00	1.1000	6716.0	130.35	.24319	2193.3	-0.	134.52	.12371	1110.1	-0.	215.88	1.0183	255.21	-0.
366.00	1.2000	6716.0	83.006	.20405	2070.4	-0.	99.487	.13541	1184.9	-0.	212.88	2.0755	247.11	-0.

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TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CHC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
367.00	1.1000	4179.0	155.23	.70905	3193.4	-0.	169.31	1.1263	1800.1	-0.	230.28	6.5690	85.309	-0.
367.00	1.2000	4179.0	190.21	.65709	3568.0	-0.	198.70	.78490	1931.4	-0.	193.04	3.2467	109.13	-0.
368.00	1.1000	5992.0	146.56	1.3563	2918.4	-0.	149.31	1.2333	1082.9	-0.	176.91	3.9666	86.458	-0.
368.00	1.2000	5992.0	161.95	1.1733	3663.2	-0.	188.26	1.2160	1806.5	-0.	241.29	6.7041	94.420	-0.
369.00	1.1000	5047.0	377.62	5.5652	959.16	-0.	379.06	4.7748	766.68	-0.	299.09	8.1450	91.334	-0.
369.00	1.2000	5047.0	374.10	5.3682	1119.0	-0.	378.43	4.2322	976.27	-0.	207.56	2.9062	186.01	-0.
370.00	1.1000	2558.0	176.91	2.4593	1755.2	-0.	217.18	1.8125	1550.2	-0.	190.76	1.6593	183.93	-0.
370.00	1.2000	2558.0	143.48	2.4004	1335.5	-0.	193.56	1.7355	1081.2	-0.	174.03	1.5091	174.97	-0.
371.00	1.1000	8510.0	107.35	.24835	2740.4	-0.	131.34	.63711	1107.2	-0.	202.53	4.0641	108.36	-0.
371.00	1.2000	8510.0	134.58	.47973	2778.0	-0.	152.69	.88157	1000.3	-0.	218.67	4.5162	105.43	-0.
372.00	1.1000	596.00	120.21	.62085	3503.8	-0.	113.15	9.78950E-02	2804.2	-0.	161.37	.82173	561.62	-0.
372.00	1.2000	596.00	113.15	.61029	3420.8	-0.	106.10	.11069	2329.9	-0.	159.94	.82536	324.00	-0.
373.00	1.1000	3801.0	117.39	1.0277	2707.7	-0.	174.20	1.9549	1707.9	-0.	138.62	2.7457	126.93	-0.
373.00	1.2000	3801.0	140.83	1.1274	2095.1	-0.	169.16	2.1904	1244.6	-0.	114.05	2.0290	111.59	-0.
374.00	1.1000	6781.0	144.20	.16462	3521.7	-0.	232.05	.38357	2690.7	-0.	170.97	1.1672	216.87	-0.
374.00	1.2000	6781.0	148.64	.15293	3637.7	-0.	212.41	.65793	2219.8	-0.	219.54	1.6845	152.50	-0.
375.00	1.1000	4682.0	245.33	2.4841	2184.1	-0.	347.28	4.8459	850.82	-0.	451.21	11.958	80.048	-0.
375.00	1.2000	4682.0	240.26	3.4026	1975.4	-0.	454.70	8.9184	630.01	-0.	366.73	10.055	79.767	-0.
376.00	1.1000	12635	172.90	1.1105	3595.2	-0.	184.25	.28453	2686.8	-0.	600.44	1.6965	144.61	-0.
376.00	1.2000	12635	81.092	1.1515	2996.5	-0.	83.862	.22278	2048.3	-0.	90.795	.44596	166.75	-0.
377.00	1.1000	3194.0	194.49	.91118	2115.3	-0.	223.06	1.2271	526.57	-0.	273.43	1.7065	99.134	-0.
377.00	1.2000	3194.0	210.82	.27598	3139.9	-0.	236.68	1.4951	949.57	-0.	363.48	6.2126	101.56	-0.
378.00	1.1000	12657	166.81	.24025	3588.8	-0.	282.45	2.1170	1228.0	-0.	258.10	7.1129	86.791	-0.
378.00	1.2000	12657	167.74	.68601	3795.0	-0.	297.07	3.1743	1143.6	-0.	385.06	10.150	67.454	-0.
379.00	1.1000	12977	82.477	.14140	2619.5	-0.	138.17	.70193	910.48	-0.	601.30	4.0494	77.297	-0.
379.00	1.2000	12977	92.551	.12796	3374.6	-0.	102.82	.57109	1297.8	-0.	302.89	5.1683	65.779	-0.
380.00	1.1000	10722	215.58	.63393	3226.2	-0.	344.24	2.7157	1443.2	-0.	503.11	8.7820	71.133	-0.
380.00	1.2000	10722	160.15	2.0130	1629.4	-0.	265.81	1.8797	1327.3	-0.	283.14	6.9025	95.542	-0.
381.00	1.1000	7816.0	140.26	.19033	3366.0	-0.	263.32	2.2552	1264.7	-0.	244.59	5.5940	105.18	-0.
381.00	1.2000	7816.0	150.12	.22783	4223.8	-0.	270.17	2.1179	1683.3	-0.	206.28	4.6340	99.134	-0.
382.00	1.1000	11302	134.37	.17359	3445.8	-0.	212.89	.37707	2102.9	-0.	237.40	3.3471	218.81	-0.
382.00	1.2000	11302	80.537	.16595	3383.5	-0.	169.41	.32297	2206.9	-0.	233.80	5.6037	136.56	-0.
383.00	1.1000	7005.0	[illegible]	.12300	2436.2	-0.	80.537	.12300	1571.4	-0.	91.741	.31140	194.24	-0.
383.00	1.2000	7005.0	[illegible]	.12951	2565.7	-0.	143.44	.12951	2071.5	-0.	154.74	.57162	173.69	-0.
384.00	1.1000	10614	[illegible]	.49756	2971.2	-0.	154.74	.69556	2450.2	-0.	101.26	.36842	171.70	-0.
384.00	1.2000	10614	90.350	.34554	2869.4	-0.	159.46	.64844	2593.3	-0.	131.14	1.6917	117.12	-0.
385.00	1.1000	3054.0	169.56	1.9507	2653.9	-0.	168.15	1.3332	1473.0	-0.	277.96	8.0424	78.755	-0.
385.00	1.2000	3054.0	112.14	1.8215	2407.8	-0.	112.14	.96682	1699.6	-0.	175.47	2.9775	117.54	-0.
386.00	1.1000	7686.0	[illegible]	.65739	2305.9	-0.	130.79	.17136	2150.0	-0.	144.75	.15899	278.70	-0.
386.00	1.2000	7686.0	101.46	.66351	2506.4	-0.	123.65	.14179	2444.2	-0.	221.83	1.4073	189.45	-0.
387.00	1.1000	5641.0	110.99	1.4179	1847.0	-0.	153.75	1.1221	1774.3	-0.	278.24	8.8224	72.101	-0.
387.00	1.2000	5641.0	120.03	2.4609	1636.0	-0.	154.02	1.9026	1587.6	-0.	159.70	2.9180	204.49	-0.
388.00	1.1000	11615	213.83	2.3277	1120.0	-0.	261.09	2.9006	526.40	-0.	308.77	7.2155	113.93	-0.
388.00	1.2000	11615	249.26	2.8736	1509.3	-0.	351.16	3.5312	645.22	-0.	449.02	7.8714	85.234	-0.
389.00	1.1000	8848.0	209.39	.21422	3224.8	-0.	372.34	2.3435	1363.1	-0.	334.07	8.5999	123.99	-0.
389.00	1.2000	8848.0	226.00	1.1904	2764.1	-0.	267.46	1.3126	1343.0	-0.	113.21	2.9160	125.91	-0.
390.00	1.1000	8005.0	76.115	.21233	3194.0	-0.	136.39	.71004	1989.1	-0.	129.34	1.9207	154.32	-0.
390.00	1.2000	8005.0	79.138	1.21104E-02	3301.8	-0.	139.62	.61096	1974.4	-0.	167.99	4.0876	111.39	-0.
391.00	1.1000	6843.0	77.804	.14163	2694.2	-0.	134.58	.25438	2264.3	-0.	168.06	2.0998	155.13	-0.
391.00	1.2000	6843.0	63.774	.14202	2773.1	-0.	132.84	.23611	2288.0	-0.	137.05	.45381	152.23	-0.
392.00	1.1000	11849	130.56	.57198	3455.8	-0.	195.62	1.2058	1938.6	-0.	261.69	3.9219	159.62	-0.
392.00	1.2000	11849	147.23	.65793	3714.3	-0.	222.39	1.4165	2183.0	-0.	288.49	3.7910	189.45	-0.
393.00	1.1000	9021.0	92.046	.20406	2613.5	-0.	143.56	.34965	1609.1	-0.	258.10	4.5357	80.656	-0.
393.00	1.2000	9021.0	60.696	.17167	2145.7	-0.	73.437	.17187	1110.1	-0.	122.49	.17809	124.61	-0.
394.00	1.1000	4804.0	92.867	.24690	2194.2	-0.	101.26	.22809	1149.6	-0.	248.91	1.3110	287.61	-0.
394.00	1.2000	4804.0	126.61	.38988	2211.9	-0.	193.88	.34554	2077.4	-0.	249.16	.85519	468.44	-0.
395.00	1.1000	6744.0	130.12	.78098	2590.5	-0.	107.51	.27054	1214.6	-0.	107.51	.20039	377.15	-0.
395.00	1.2000	6744.0	90.340	.84164	1819.7	-0.	95.949	.41215	1086.8	-0.	74.944	.15345	470.18	-0.
396.00	1.1000	12272	162.02	.37326	2227.7	-0.	225.66	.15947	1719.8	-0.	368.39	1.0752	289.23	-0.
396.00	1.2000	12272	214.75	.56583	2100.5	-0.	293.07	.37306	1677.8	-0.	423.74	1.6043	226.41	-0.
397.00	1.1000	12019	122.49	.48213	3792.6	-0.	139.41	.20553	3156.0	-0.	109.83	.64780	128.65	-0.
397.00	1.2000	12019	6.9262	.35544	2667.0	-0.	6.9262	.20024	1194.0	-0.	153.06	2.4679	124.13	-0.
398.00	1.1000	12962	179.99	.91268	3102.7	-0.	224.16	.23688	3224.7	-0.	112.31	.40989	187.78	-0.
398.00	1.2000	12962	145.58	1.4507	2645.2	-0.	218.23	.25215	3203.2	-0.	158.97	1.6593	147.71	-0.
399.00	1.1000	6597.0	110.91	.46111	2280.5	-0.	124.93	.15472	1488.2	-0.	137.59	.63915	156.23	-0.
399.00	1.2000	6597.0	127.21	.44011	2668.7	-0.	145.83	.21990	1760.3	-0.	180.39	1.6734	147.36	-0.

119

TABLE 1

SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
400.00	1.1000	5214.0	64.765	.11654	2945.0	-0.	68.947	.68140	1290.7	-0.	57.855	.63487	125.31	-0.
400.00	1.2000	5214.0	139.25	.27193	2966.4	-0.	139.25	.70607	1335.4	-0.	127.86	.30980	144.50	-0.
401.00	1.1000	6016.0	126.04	.17777	2756.1	-0.	204.67	.37899	1369.0	-0.	287.62	3.6362	147.66	-0.
401.00	1.2000	6016.0	78.779	.17288	2163.4	-0.	125.50	.24822	1216.2	-0.	192.17	2.0770	133.76	-0.
402.00	1.1000	4382.0	83.585	.16412	1944.6	-0.	97.643	.27791	1347.7	-0.	215.77	6.8653	153.58	-0.
402.00	1.2000	4382.0	80.179	.20973	2699.6	-0.	88.543	.19723	1328.1	-0.	102.51	.64115	305.99	-0.
403.00	1.1000	6275.0	100.61	.23480	2365.8	-0.	128.90	.17229	1866.3	-0.	164.46	2.9365	181.03	-0.
403.00	1.2000	6275.0	129.41	.36214	2458.8	-0.	157.66	.17266	2083.2	-0.	157.66	1.0936	258.15	-0.
404.00	1.1000	16061	60.128	.15173	1978.2	-0.	57.317	.17630	869.16	-0.	152.32	2.5548	209.22	-0.
404.00	1.2000	16061	146.12	.14701	2419.7	-0.	137.66	.14701	1166.7	-0.	161.66	1.6024	203.89	-0.
405.00	1.1000	13775	135.33	.80878	2570.2	-0.	147.72	.55094	1614.4	-0.	212.91	4.2638	142.63	-0.
405.00	1.2000	13775	125.75	.47065	2196.9	-0.	156.95	.55554	1425.5	-0.	155.52	.78163	325.41	-0.
406.00	1.1000	6507.0	123.04	.47668	2423.6	-0.	137.20	.41862	1531.6	-0.	123.04	.86216	326.64	-0.
406.00	1.2000	6507.0	104.12	.47815	1621.9	-0.	122.14	.45869	994.61	-0.	95.826	.21018	387.59	-0.
407.00	1.1000	9286.0	111.57	2.3261	732.12	-0.	203.96	3.6273	166.21	-0.	309.66	7.5034	77.702	-0.
407.00	1.2000	9286.0	115.34	1.7189	1094.3	-0.	178.94	2.8440	239.72	-0.	256.28	5.7583	71.962	-0.
408.00	1.1000	6467.0	69.049	.15329	1342.0	-0.	129.15	.13473	1685.0	-0.	398.64	.48260	188.33	-0.
408.00	1.2000	6467.0	122.19	.15966	1853.7	1714.0	180.09	.20947	1767.1	1686.0	299.29	.59000	224.63	192.00
409.00	1.1000	10528	80.031	.31015	2400.6	-0.	122.56	.93757	1465.3	-0.	139.12	2.8163	114.47	-0.
409.00	1.2000	10528	106.73	.46359	3054.1	-0.	145.58	.95062	1758.6	-0.	113.65	.17830	169.85	-0.
410.00	1.1000	32322	92.903	.15961	2242.5	-0.	151.62	.28476	1553.9	-0.	192.97	5.8327	127.89	-0.
410.00	1.2000	32322	157.66	.15860	3137.7	3105.9	196.37	.29545	1807.6	1792.1	157.66	.58335	272.70	248.81
411.00	1.1000	22543	152.22	1.0043	1967.7	1908.0	220.67	.77759	1631.6	1545.1	192.04	1.2381	222.25	223.50
411.00	1.2000	22543	98.072	1.1137	1756.5	-0.	161.18	1.1279	1372.2	-0.	85.539	.63231	397.27	-0.
412.00	1.1000	6467.0	71.531	.14800	3140.6	-0.	111.22	.19798	2235.0	-0.	164.12	3.9124	96.973	-0.
412.00	1.2000	6467.0	105.05	.13510	3495.0	3272.0	141.96	.15371	2197.6	-0.	141.96	1.2696	122.23	96.233
413.00	1.1000	14918	212.23	.81121	2862.4	-0.	308.37	1.6974	1722.1	-0.	388.35	7.7668	75.256	-0.
413.00	1.2000	14918	292.67	1.7582	2634.6	2555.4	309.56	2.2950	1675.5	-0.	286.81	.80754	215.87	-0.
414.00	1.1000	15693	171.19	1.5887	2111.1	2049.7	155.52	.31114	1925.8	1825.4	191.19	.13533	413.61	349.59
414.00	1.2000	15693	157.90	1.7869	2112.5	1853.0	152.02	.32386	2129.5	1973.7	221.51	.47166	338.20	274.08
415.00	1.1000	8400.0	73.362	.20425	2184.8	2173.0	106.92	.21053	1262.6	1158.0	125.18	1.0885	252.49	192.00
415.00	1.2000	8400.0	46.594	.19666	1884.1	1775.5	67.909	.18422	1419.2	1315.5	106.49	1.6475	240.01	185.45
416.00	1.1000	7218.0	137.33	.15501	3282.4	3139.4	175.14	.39042	1774.2	1686.1	266.42	6.5565	82.506	38.573
416.00	1.2000	7218.0	141.66	.15371	3289.6	3057.5	175.14	.17860	1953.2	1819.6	183.91	.71443	178.72	128.16
417.00	1.1000	9510.0	135.53	.23490	2602.8	2415.5	182.33	.36152	1955.5	1764.3	273.64	3.7141	122.09	64.229
417.00	1.2000	9510.0	63.255	.15449	3155.5	2872.4	115.84	.34414	2483.1	2311.2	221.13	3.5694	119.44	83.440
418.00	1.1000	31036	202.75	2.4871	2339.6	2242.5	208.53	1.8602	1588.6	1430.9	225.92	7.3933	111.33	89.830
418.00	1.2000	31036	144.04	2.2695	2236.0	2157.3	144.04	1.2525	1366.9	1274.8	205.95	7.0129	103.74	70.636
419.00	1.1000	14061	142.81	.97384	2530.6	2447.1	145.71	.19107	2128.2	2011.7	239.22	4.5113	97.777	51.407
419.00	1.2000	14061	183.58	1.6239	2222.7	2200.0	201.28	.67885	1920.2	1984.6	283.05	5.7758	76.639	32.152
420.00	1.1000	4960.0	68.012	.28966	3647.6	3552.6	80.583	.22710	1863.3	1797.7	116.72	1.4559	141.86	83.440
420.00	1.2000	4960.0	78.004	.24233	3533.6	3428.9	103.78	.21712	1987.2	1836.4	139.80	9.0038	121.81	70.636
421.00	1.1000	6554.0	125.56	.36152	2714.5	2519.4	154.51	.36152	1918.8	1797.7	242.34	5.9713	107.90	64.229
421.00	1.2000	6554.0	44.025	.20323	2241.2	2151.9	78.927	.16587	1552.5	1488.1	121.60	3.3192	171.41	134.54
422.00	1.1000	9814.0	90.602	.96962	2723.2	2631.9	109.20	.69804	1518.0	1407.9	171.17	4.1470	98.476	64.229
422.00	1.2000	9814.0	150.00	.73969	2940.0	2847.6	160.05	.45052	1733.3	1601.7	139.96	.12247	148.20	96.233
423.00	1.1000	22127	104.42	1.8779	2007.8	-0.	119.29	1.4556	1280.0	-0.	177.70	6.3592	154.79	-0.
423.00	1.2000	22127	104.42	1.8347	1533.4	1507.8	129.04	1.3289	1114.6	1033.7	184.48	6.1183	108.19	83.440
424.00	1.1000	3172.0	80.428	.19466	2410.9	2178.7	83.090	.13762	1608.1	1459.5	134.44	.31003	325.94	261.45
424.00	1.2000	3172.0	125.86	.20967	2111.9	1995.4	128.75	.16618	1300.1	1251.5	195.79	.38720	172.82	115.40
425.00	1.1000	1877.0	65.153	.15269	3297.8	3224.9	121.04	.18980	2099.6	2006.3	157.17	1.5370	150.58	115.40
425.00	1.2000	1877.0	97.744	.20784	3506.9	3360.6	121.71	.29778	2215.0	2092.9	158.04	1.3948	135.74	102.62
426.00	1.1000	6961.0	101.07	.25180	2549.0	2560.5	124.86	.15007	1344.8	1303.9	155.86	.10599	311.02	242.49
426.00	1.2000	6961.0	107.91	.53352	2469.2	2348.0	119.55	.14197	1503.3	1356.0	173.73	.33126	203.17	128.16
427.00	1.1000	10391	267.53	2.1501	1445.4	1332.9	292.67	.22265	1574.4	1436.6	591.45	1.9897	188.36	102.62
427.00	1.2000	10391	251.42	2.2620	1316.1	1234.0	288.54	.16551	1356.3	1228.2	518.47	1.0888	197.81	128.16
428.00	1.1000	11480	170.25	.60449	2660.7	2615.3	179.06	.75166	1574.1	1481.4	291.87	7.6261	91.279	51.563
428.00	1.2000	11480	151.50	.68602	1978.6	1900.6	166.02	1.0645	1061.5	991.51	166.02	1.6972	122.41	95.629
429.00	1.1000	12923	151.23	1.1310	3127.0	3009.3	142.47	.14888	2650.2	2408.6	168.79	1.5040	120.03	84.035
429.00	1.2000	12923	267.32	.65256	3005.5	2932.8	272.58	.18551	1612.8	1750.1	287.32	2.5819	131.94	85.234
430.00	1.1000	28497	184.96	.29667	3492.5	3479.5	211.11	.25267	2087.8	1800.5	406.76	8.2678	74.800	25.840
430.00	1.2000	28497	199.48	.25267	3680.0	3361.1	228.60	.25267	1950.6	1811.8	263.76	1.3285	143.94	95.567
431.00	1.1000	5720.0	162.28	2.0100	1786.6	1713.0	202.93	.66877	1756.1	1674.0	240.00	1.2960	210.56	146.74
431.00	1.2000	5720.0	143.05	2.2988	1720.1	-0.	169.19	1.3465	1550.3	-0.	199.88	.72050	209.52	224.49
432.00	1.1000	11688	147.39	.31069	2631.3	2538.2	156.10	.31069	1065.2	965.19	154.65	.34248	153.16	96.524
432.00	1.2000	11688	149.57	.34237	2659.6	2590.2	178.57	.69855	989.20	901.94	256.14	5.0004	108.90	83.412

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TESTS 1A AND 1B

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (

CAR NO	TEST NO	MILEAGE	HC 01	CO 01	NOX 01	NOXP 01	HC 02	CO 02	NOX 02	NOXP 02	HC 03	CO 03	NOX 03	NOXP 03
433.00	1.1000	13128	232.96	1.7269	2603.5	2549.8	250.64	1.6290	1308.8	1189.3	240.32	3.5595	95.530	64.337
433.00	1.2000	13128	121.14	1.0929	2185.0	2081.6	131.24	.59125	1255.4	1140.1	211.29	7.6000	81.855	25.600
434.00	1.1000	7624.0	200.72	1.5869	1669.0	1540.8	178.65	.69519	796.34	681.00	304.00	7.5822	100.67	51.632
434.00	1.2000	7624.0	153.95	1.4722	1941.0	1839.2	109.71	.46826	949.32	842.04	123.94	.46174	283.25	190.47
435.00	1.1000	11979	317.93	3.1181	1767.8	1726.5	375.09	6.7145	260.04	382.35	390.23	5.9699	73.826	32.271
435.00	1.2000	11979	148.81	2.8152	2087.7	1880.1	283.07	6.1694	393.70	278.80	325.19	8.0352	83.256	12.798
436.00	1.1000	4670.0	62.744	.36537	2494.5	2461.8	153.67	1.5284	1260.5	1175.8	117.36	1.7190	117.57	80.401
436.00	1.2000	4670.0	34.082	.23469	1985.0	-0.	52.636	.50936	1165.4	-0.	34.082	.21589	115.06	-0.
437.00	1.1000	6730.0	154.66	.80781	2803.3	2697.7	91.683	.19871	830.95	666.86	226.60	6.9313	90.287	36.638
437.00	1.2000	6730.0	128.41	.98951	2796.5	-0.	161.37	.33050	2865.3	-0.	210.46	6.6270	93.339	-0.
438.00	1.1000	15918	241.35	4.7433	726.20	613.22	197.95	.28126	1195.8	1026.4	466.86	5.8698	136.35	77.377
438.00	1.2000	15918	70.926	.45469	3207.2	3092.8	128.36	.69192	1173.7	1115.4	308.96	2.2679	137.52	102.52
439.00	1.1000	6894.0	163.30	1.3855	2157.9	-0.	186.43	1.6395	869.23	-0.	170.52	4.0858	143.46	-0.
439.00	1.2000	6894.0	170.76	1.0466	2584.8	2495.0	199.79	2.4371	824.01	716.33	221.65	6.7725	90.725	32.227
440.00	1.1000	24942	84.574	.28804	2617.0	-0.	106.29	.28229	1707.5	-0.	74.469	.37872	401.99	-0.
440.00	1.2000	24942	79.043	.18635	3198.8	3020.6	100.81	.21786	1978.6	1823.8	74.701	.84299	332.85	311.73
441.00	1.1000	14206	147.07	1.1144	3058.7	-0.	106.29	.22265	1136.4	-0.	135.39	.24780	97.572	-0.
441.00	1.2000	14206	141.37	.99187	3679.1	3838.2	131.24	.19199	1930.7	3629.8	179.12	.53853	82.039	1892.4
442.00	1.1000	16787	95.106	.77470	2715.3	2642.2	113.64	.61992	1611.5	1502.6	256.12	4.3620	74.547	32.098
442.00	1.2000	16787	86.975	.97911	2341.6	2313.7	104.66	.50636	1484.2	1408.0	434.69	1.1768	68.411	38.883
443.00	1.1000	13774	145.06	1.0401	2307.3	2299.1	177.51	.72897	1957.4	1779.1	294.19	7.4987	74.621	32.403
443.00	1.2000	13774	130.84	.65020	2061.0	2615.6	153.93	.50460	1569.3	1527.4	216.48	5.4976	100.05	65.400
444.00	1.1000	15506	204.47	3.7770	1413.0	1321.5	210.30	2.9470	598.64	501.54	208.85	3.7972	115.90	51.632
444.00	1.2000	15506	131.04	2.1046	2046.7	1946.7	151.27	2.0072	986.47	889.26	154.17	1.8713	192.48	127.19
445.00	1.1000	5309.0	127.04	.21563	1897.2	1739.0	282.72	1.4611	1270.3	1103.9	590.92	4.9847	50.927	19.384
445.00	1.2000	5309.0	129.20	.17498	2020.6	1783.8	271.96	1.3491	1291.5	1038.4	343.30	3.2736	75.343	32.293
446.00	1.1000	3773.0	197.72	.15446	2879.4	2234.2	353.62	2.0376	1907.2	1863.4	424.24	5.2640	112.33	66.004
446.00	1.2000	3773.0	201.13	.29496	2858.0	-0.	347.67	2.5104	1526.6	-0.	578.53	7.6609	88.196	-0.
447.00	1.1000	7206.0	127.31	.76518	3078.2	2956.2	104.19	.99187	663.79	587.68	166.54	4.2881	113.35	64.424
447.00	1.2000	7206.0	272.30	.29572	2325.6	2128.9	116.29	.34723	527.90	446.15	442.66	4.9333	104.15	51.019
448.00	1.1000	9261.0	166.28	.13498	4281.2	4134.8	296.00	2.4748	2006.0	1909.0	487.44	8.4660	133.41	113.94
448.00	1.2000	9261.0	156.10	.13603	3805.8	-0.	234.42	1.7739	1654.2	-0.	241.86	3.5580	94.479	-0.
449.00	1.1000	27162	147.16	.51410	4090.7	3991.0	157.31	.51410	1697.3	1575.3	217.16	2.8959	124.31	95.692
449.00	1.2000	27162	40.953	.15565	1882.4	1784.7	83.665	.70443	974.62	691.92	112.33	.27649	253.69	192.55
450.00	1.1000	7007.0	141.72	.22275	4574.6	4358.3	254.95	1.4080	2878.4	2820.4	284.37	3.5284	146.53	103.36
450.00	1.2000	7007.0	145.03	.13543	4742.4	-0.	285.26	2.3834	1935.6	-0.	295.63	4.2320	122.41	-0.
ESTIMATE OF MEAN			131.07	.84170	2541.7	2465.5	162.09	.89717	1504.3	1447.4	219.24	3.0786	170.06	131.90
ESTIMATE OF STANDARD DEVIATION			54.946	1.0093	752.20	726.04	70.270	1.1009	567.54	575.55	155.44	2.6274	95.979	227.39
DEGREES OF FREEDOM			298	298	297	68	298	298	297	66	298	298	297	68
T VALUE			41.249	14.420	58.331	28.208	39.886	14.091	45.756	20.584	24.390	20.261	30.587	4.8181

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
301.00	2.0000	6806.0	94.060	.30815	2454.1	2427.9	177.85	.22679	2224.2	2173.3	217.98	1.1324	165.31	137.04
302.00	2.0000	7157.0	69.560	.56968	1628.4	1545.5	138.60	.23524	1804.6	1703.8	211.39	.27939	444.33	391.64
303.00	2.0000	5685.0	113.39	.96218	-0.	1582.8	98.725	.46328	-0.	945.63	212.69	.26253	-0.	13.002
304.00	2.0000	5497.0	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
305.00	2.0000	5106.0	169.60	.50133	3430.6	3325.6	140.73	.40474	1357.0	1258.9	140.73	2.7089	218.63	175.06
306.00	2.0000	5224.0	135.79	.30571	2291.7	2137.0	92.532	.28663	660.27	597.44	104.03	1.2687	248.69	176.30
307.00	2.0000	6659.0	156.10	.29796	3323.6	-0.	114.12	.23358	1194.9	-0.	143.03	2.3081	202.42	-0.
308.00	2.0000	5926.0	152.96	.45014	3445.5	-0.	125.47	.32060	1272.2	-0.	145.71	2.7369	167.83	-0.
309.00	2.0000	5508.0	143.03	.29735	3168.7	-0.	104.03	.26473	1069.3	-0.	105.47	.78676	251.73	-0.
310.00	2.0000	5262.0	133.93	.42862	2878.1	-0.	86.524	.23652	941.30	-0.	108.02	.74053	260.15	-0.
311.00	2.0000	5510.0	146.93	.24097	2601.1	2324.9	99.410	.20964	410.04	635.84	113.77	.54197	286.30	226.19
312.00	2.0000	5510.0	142.39	.26558	3681.2	3400.7	89.274	.21545	1128.6	1025.3	105.01	1.3386	266.00	192.90
313.00	2.0000	5002.0	145.75	.40818	3473.5	3265.9	97.224	.26339	1135.6	974.42	111.88	.99638	283.70	160.64
315.00	2.0000	6688.0	60.505	.45326	1653.7	1565.8	156.91	.45976	1450.5	1339.2	247.51	.91519	204.04	179.17
316.00	2.0000	6877.0	67.441	.55981	1773.9	1722.9	151.79	.25594	1696.9	1638.4	228.51	.62542	206.45	162.17
317.00	2.0000	7336.0	62.352	.26006	2214.1	-0.	147.06	.20356	1917.0	-0.	225.72	.77529	330.02	-0.
318.00	2.0000	5282.0	102.51	.69154	2409.7	2289.9	134.65	.17617	2003.1	1863.3	158.14	.28141	319.07	284.25
319.00	2.0000	8152.0	67.142	.32007	1847.8	1832.7	182.98	.19924	1641.6	1642.0	219.20	.50830	314.76	273.84
320.00	2.0000	6884.0	86.352	.48449	2247.1	2177.9	193.27	.29832	2506.2	2476.0	209.56	.19130	467.80	383.52
321.00	2.0000	5952.0	111.64	.33048	3259.5	-0.	167.63	1.2801	1772.9	-0.	208.17	4.1469	145.19	-0.
322.00	2.0000	19226	116.46	.96549	2995.5	2937.3	160.25	.45295	2553.0	2343.8	196.99	1.0764	426.05	352.67
323.00	2.0000	4997.0	91.122	.72161	2701.8	2538.8	93.993	.14135	1993.7	1770.2	145.95	3.0362	123.57	72.063
324.00	2.0000	9270.0	119.23	.11733	5037.9	4086.1	214.10	.99450	2868.8	2436.3	205.18	3.8777	118.10	83.101
325.00	2.0000	[illegible]	100.67	.68821	-0.	2622.8	166.37	.32324	-0.	2647.4	188.45	3.1734	-0.	106.65
326.00	2.0000	[illegible]	59.612	.23177	4081.2	3916.8	88.523	.20086	1992.8	1921.8	134.77	1.5787	163.42	129.04
327.00	2.0000	12933	97.669	.34403	3724.1	3695.4	80.307	.16569	1435.6	1258.5	112.18	.69791	150.19	112.90
328.00	2.0000	7224.0	143.79	.24603	2302.9	2239.2	175.94	.45796	1432.4	1340.8	197.96	3.1299	198.35	124.90
329.00	2.0000	8890.0	123.81	.43021	2251.4	2042.4	113.63	.19306	1442.1	1398.9	383.15	2.5456	259.43	176.50
330.00	2.0000	12864	82.818	.27617	2730.2	2568.4	116.01	.48362	1973.0	1744.3	134.85	.47048	802.84	490.29
331.00	2.0000	19629	65.643	.30199	2417.8	2309.3	71.388	.16634	1648.3	1565.1	169.98	.88501	310.62	259.28
332.00	2.0000	11689	174.75	.50523	3541.2	3504.5	339.96	2.8091	1074.9	990.40	241.15	8.0909	106.52	51.794
333.00	2.0000	40103	88.327	.61860	2158.0	2043.6	72.554	.84134	823.98	534.48	102.76	1.0357	214.03	155.05
334.00	2.0000	11777	85.976	1.2138	2640.0	2697.4	71.555	.43230	1558.7	1460.6	71.555	.89126	165.67	97.487
335.00	2.0000	16165	50.145	.36294	1255.1	1190.3	27.166	.33045	695.07	628.71	125.48	1.2255	149.52	155.34
336.00	2.0000	4122.0	131.57	.62250	3814.7	3789.5	186.82	1.3968	1600.9	1577.1	213.16	7.3761	144.00	91.125
337.00	2.0000	10739	121.11	1.0273	3451.3	3530.3	122.57	.74188	1562.7	1500.1	154.73	4.6732	135.67	84.491
338.00	2.0000	6416.0	174.36	1.2224	1806.1	3501.8	181.74	2.3809	1045.4	1026.4	209.88	2.7817	123.44	78.060
339.00	2.0000	17361	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
340.00	2.0000	6302.0	164.75	1.5375	1081.6	1523.5	185.00	1.7595	974.95	825.04	133.10	2.0365	59.944	29.498
341.00	2.0000	9728.0	57.347	.23482	3650.4	3768.7	57.347	.15365	1002.4	933.68	137.16	2.5764	120.16	77.604
342.00	2.0000	11135	93.060	.12212	3293.9	3351.2	146.73	.17773	2380.5	2359.6	177.41	3.7862	141.05	96.256
343.00	2.0000	5930.0	87.957	.97252	3245.1	3290.2	159.62	1.4925	2438.5	2366.0	224.75	6.6175	193.24	148.37
344.00	2.0000	39870	185.59	3.1776	1572.5	1449.6	156.83	1.4228	1236.3	1137.9	143.93	2.8644	198.01	138.59
346.00	2.0000	11969	141.17	.78997	3278.9	3217.0	147.07	.63039	1830.1	1766.3	119.11	1.9594	334.63	283.04
347.00	2.0000	8519.0	55.196	.35958	2613.5	2585.6	60.888	.16523	1935.3	1780.3	125.32	.32157	309.68	303.45
348.00	2.0000	12219	83.985	.47877	2395.2	2213.9	104.45	.55032	1305.9	1154.5	264.83	3.9614	231.66	194.77
349.00	2.0000	13579	110.92	1.9578	1357.5	1255.9	116.74	3.0969	274.93	215.20	256.81	7.8762	76.489	19.710
350.00	2.0000	14480	122.32	.20433	2993.7	2984.9	150.03	.87387	1173.1	723.17	185.23	5.1192	113.18	78.110
351.00	2.0000	13684	117.46	.28557	3900.4	3817.4	170.46	.94007	2397.3	2335.5	142.42	2.0403	172.60	122.09
352.00	2.0000	9869.0	96.388	.24022	3429.1	3394.6	110.92	.37253	2017.0	1951.7	79.003	.76470	408.09	328.95
353.00	2.0000	10727	152.72	.35241	4091.4	3973.1	192.28	.16783	2533.7	2530.3	224.39	5.1293	94.504	64.718
354.00	2.0000	25824	45.669	.19704	2268.3	2186.6	39.940	.22204	846.70	786.64	229.17	3.2469	120.30	84.174
355.00	2.0000	8573.0	94.957	.56028	3674.9	3614.7	69.638	.15316	2218.8	2092.5	99.190	.45288	139.19	80.974
356.00	2.0000	6581.0	25.457	.14395	2216.4	2040.5	46.776	.15193	1394.7	1230.3	89.699	9.17793E-0.	271.97	190.78
357.00	2.0000	9152.0	55.708	.93493	2209.6	2144.2	114.87	.92120	1334.2	1246.0	173.20	3.5604	96.914	51.865
358.00	2.0000	13030	207.21	1.1965	3431.8	3338.0	289.13	4.3105	695.15	621.89	392.04	7.7300	119.77	51.047
359.00	2.0000	19047	179.27	.49177	3146.7	3001.3	113.62	.46113	915.85	619.62	156.34	1.9307	176.97	143.77
350.00	2.0000	32631	180.90	1.1717	2229.1	2116.4	175.14	2.4200	969.72	821.21	230.12	5.0891	116.76	84.404
363.00	2.0000	7015.0	177.07	.51183	4489.3	4331.8	325.61	1.2100	2524.7	2599.5	500.29	8.2451	113.64	42.437
364.00	2.0000	9874.0	101.65	.52652	3314.9	3218.6	164.76	.35556	2720.8	2602.2	113.07	.45372	305.42	257.89
365.00	2.0000	12174	141.29	.54975	2653.6	2484.4	81.480	.13687	637.51	590.42	172.89	1.3022	207.57	159.03
366.00	2.0000	11913	105.44	.29968	2960.3	2902.3	126.79	.19218	1910.4	1810.2	176.95	1.8419	356.55	314.77
367.00	2.0000	9524.0	109.37	.48888	4278.2	4161.6	152.06	.85855	2589.9	2466.0	163.50	5.6251	120.95	58.652
368.00	2.0000	8917.0	139.43	1.3291	3699.8	3573.2	132.30	.97071	1938.0	1667.0	217.08	6.4565	106.44	71.336
369.00	2.0000	8708.0	351.57	5.4486	1184.6	1089.1	370.90	4.3337	979.66	900.38	192.21	4.1917	216.50	202.24
370.00	2.0000	5916.0	123.00	1.0560	2071.9	1995.6	194.20	.64502	1528.4	1441.2	177.02	3.9871	87.248	65.738

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
371.00	2.0000	14882	217.08	7.5266	351.63	262.64	212.74	7.1193	214.40	139.23	266.58	8.8356	82.437	44.113
372.00	2.0000	5414.0	71.359	.20543	3404.3	3280.0	79.819	.13008	1513.1	1335.1	130.87	.09895	267.75	251.37
373.00	2.0000	12065	176.35	1.4314	3006.0	3029.7	210.13	2.0800	1381.5	1292.1	198.55	3.0328	104.75	66.042
374.00	2.0000	10631	124.71	.15494	3437.9	2184.8	185.30	.40966	2142.2	2002.4	198.37	.85656	139.80	80.352
375.00	2.0000	6775.0	224.62	3.6983	1905.9	1952.1	287.87	3.4215	1730.0	1279.0	188.20	5.1237	140.16	93.449
376.00	2.0000	20248	150.38	2.0931	2755.5	2626.6	191.89	1.0704	2456.9	2340.3	156.08	2.4934	157.56	100.67
377.00	2.0000	5305.0	256.35	.57600	2758.1	2348.1	215.64	1.3379	357.34	243.52	251.97	4.3719	69.757	21.663
378.00	2.0000	19147	63.271	.37692	1828.9	1774.0	90.389	.34629	601.60	536.76	233.38	8.7056	69.460	30.415
379.00	2.0000	20800	72.976	.16822	2996.2	2870.3	119.83	.62597	1171.7	1021.6	241.02	4.6662	62.792	28.835
380.00	2.0000	13882	257.15	6.8730	545.00	407.83	292.42	2.7808	878.95	728.41	299.80	7.1996	113.07	50.716
381.00	2.0000	12639	144.94	.21012	3664.5	3571.6	250.78	2.9894	864.55	737.36	184.38	4.8840	105.20	50.395
383.00	2.0000	13060	79.491	.16766	2326.6	2259.1	118.26	.14884	1767.6	1618.8	246.04	6.0004	117.39	50.716
384.00	2.0000	21061	126.33	.43302	3386.0	3273.6	152.25	.40084	2294.3	2161.0	142.15	1.5090	131.03	87.936
386.00	2.0000	13476	99.096	.32132	-0.	2653.4	126.32	.16210	-0.	1820.7	124.89	.37947	-0.	151.53
387.00	2.0000	10573	136.16	1.4395	2897.0	2815.6	154.90	.64226	1911.3	1800.0	226.07	5.7107	137.54	65.288
388.00	2.0000	21432	243.22	2.9223	1645.0	1519.8	298.84	3.6959	755.00	628.88	1020.8	7.2770	79.815	21.899
389.00	2.0000	-0.	125.53	1.4655	3146.5	3086.3	122.68	.72787	2059.5	1966.7	187.28	4.5664	122.43	70.990
390.00	2.0000	18376	100.72	.20566	3828.7	3562.7	161.81	.72881	2467.3	2208.5	176.13	3.2356	229.44	75.946
391.00	2.0000	11264	83.162	.16050	3285.5	3301.1	132.29	.17924	2412.2	2439.6	139.35	.36924	129.89	122.64
392.00	2.0000	19623	134.95	.55066	3763.5	3615.9	208.87	1.1879	2284.0	2216.6	263.86	4.4896	175.20	122.04
393.00	2.0000	14282	77.585	.17337	3033.4	2998.3	139.06	.15460	2235.6	2120.5	134.75	.12343	190.94	114.80
394.00	2.0000	8902.0	137.56	.19957	2650.5	318.71	176.11	.13037	1962.2	1902.6	284.71	1.5829	400.46	2667.1
395.00	2.0000	13830	136.76	.67561	2571.2	2562.8	108.27	.36569	1257.8	1142.8	89.828	.14290	450.16	382.10
396.00	2.0000	15103	166.34	.60998	2835.2	2811.9	234.10	.20002	2193.4	2102.4	237.01	.58995	366.98	294.71
397.00	2.0000	16202	102.12	.27456	4764.1	4666.7	126.19	.28092	3606.9	414.39	117.69	.69265	167.45	101.14
398.00	2.0000	22149	157.27	.98003	3306.4	3170.0	167.35	.18735	3161.9	3037.4	110.02	.17472	146.96	87.037
399.00	2.0000	11251	115.95	.25619	3057.9	2668.5	144.93	.20552	2018.5	1704.2	247.48	1.9125	291.32	76.131
401.00	2.0000	9428.0	105.84	.21230	2846.3	2676.7	146.39	.70285	1206.3	1044.3	218.00	6.2157	119.36	55.295
402.00	2.0000	8682.0	130.09	.20574	2767.7	2596.8	132.95	.16163	1280.2	1136.8	135.81	.22473	324.84	241.00
403.00	2.0000	9537.0	76.699	.40556	2785.9	2614.3	95.913	.16740	2215.4	2040.6	90.056	1.2302	308.25	223.77
404.00	2.0000	25479	70.468	.16103	2699.6	2682.3	86.100	.20497	1351.8	1259.4	130.41	1.6739	219.06	172.05
405.00	2.0000	19354	140.90	.66684	2694.0	2532.8	155.18	.81376	1437.4	1329.9	183.83	4.5847	176.00	104.79
406.00	2.0000	12193	65.129	.21619	1567.5	1432.1	73.866	.30086	870.63	723.08	70.952	.10519	45.12	173.52
407.00	2.0000	13651	141.97	2.5383	1065.4	911.61	147.72	1.4841	608.68	465.74	214.23	3.8042	76.577	26.176
408.00	2.0000	13202	101.06	.15569	2105.0	1985.4	164.55	.14330	2130.7	2009.9	148.61	.34731	175.77	118.69
410.00	2.0000	38147	101.00	.24349	2426.1	2234.8	125.07	.27147	1540.8	1356.2	156.54	3.0002	141.36	117.17
411.00	2.0000	31762	110.58	1.0147	1989.4	1778.0	140.02	.50689	1532.6	1347.6	87.130	.24599	290.91	206.79
412.00	2.0000	20554	229.13	.15535	3376.7	3311.5	278.97	.26284	2559.4	2394.4	255.47	.90036	122.52	55.404
413.00	2.0000	21066	274.13	2.2167	2334.8	2176.6	360.83	3.0266	1214.2	1014.0	281.55	1.8935	189.49	117.51
414.00	2.0000	23632	158.99	1.5297	2600.7	2444.9	142.90	.21854	2630.6	2479.5	219.34	1.0339	394.62	294.72
415.00	2.0000	9455.0	112.13	.17579	3870.4	3781.2	152.90	.74338	1643.7	1402.3	160.21	2.3718	143.72	75.693
417.00	2.0000	13674	93.416	.18090	3189.0	2956.1	145.13	.64301	2030.4	1811.3	255.94	5.5263	122.57	52.939
418.00	2.0000	46543	129.30	2.0886	2227.9	2023.7	135.18	1.0499	1726.2	1560.5	216.07	8.3015	108.82	62.046
419.00	2.0000	19896	277.14	.64709	3504.3	3198.9	258.96	.15665	2793.7	2531.3	277.14	2.8246	130.13	55.243
420.00	2.0000	10097	69.603	.21927	4235.6	4041.2	109.11	.23337	2255.8	2042.6	128.23	1.7114	170.71	80.449
421.00	2.0000	10705	100.00	.25676	2610.2	2456.5	133.71	.14296	1742.4	1575.3	175.00	2.3332	207.21	137.75
422.00	2.0000	14801	85.800	.65880	3342.0	3104.1	104.87	.36105	1962.8	1774.7	84.335	.10589	179.37	116.17
423.00	2.0000	25688	67.935	1.8346	1969.5	1786.8	63.946	1.5491	1049.1	905.50	136.65	4.6412	169.20	122.97
424.00	2.0000	10478	70.303	.24039	2624.6	2466.0	115.21	.15093	2283.0	2073.1	216.39	2.2207	197.52	115.84
425.00	2.0000	5526.0	88.050	.16774	3473.6	3480.3	124.51	.37796	1993.6	1821.4	146.50	2.2113	148.47	61.174
426.00	2.0000	11300	94.594	.18153	2418.7	2244.9	132.85	.14361	1300.9	1060.9	258.15	.34161	223.60	99.756
427.00	2.0000	-0.	168.82	1.7264	1753.1	1598.8	170.30	.15466	1492.3	1326.5	249.06	.38957	195.90	138.15
428.00	2.0000	19472	83.817	.62405	2163.6	-0.	96.929	.83487	1175.6	-0.	136.44	4.3004	155.69	-0.
429.00	2.0000	17373	92.841	.79360	2775.1	2590.2	86.996	.15597	1464.0	1316.2	130.97	3.7634	113.72	62.046
430.00	2.0000	36660	140.33	.24050	3882.2	3673.1	167.30	.46637	1906.4	1736.0	201.93	2.4695	152.33	111.43
431.00	2.0000	7773.0	148.88	2.4380	1833.3	-0.	171.09	1.1068	1988.0	-0.	217.25	1.4049	194.36	-0.
432.00	2.0000	18797	128.26	.52801	3130.6	3005.2	144.48	1.0391	1055.1	913.77	235.77	6.4509	115.43	55.045
433.00	2.0000	20487	101.15	1.3707	1726.2	1498.3	96.780	.70665	900.80	767.63	104.07	2.9086	71.201	35.037
434.00	2.0000	11893	135.39	1.5392	1575.5	1425.6	73.866	.35800	673.81	566.47	62.616	.18002	221.21	172.76
435.00	2.0000	16491	133.09	1.4146	3106.4	2963.1	237.86	4.9043	510.66	408.37	446.88	10.077	53.121	14.011
436.00	2.0000	8135.0	51.966	.53256	1742.1	1413.4	65.028	.97049	738.74	499.21	51.966	.82398	208.06	49.205
437.00	2.0000	10457	80.192	.23917	1891.1	1695.8	103.72	8.04728E-02	2131.9	1925.0	136.23	3.1996	56.237	41.097
439.00	2.0000	10982	137.97	.67231	2876.8	2741.7	212.66	2.6031	776.07	703.46	148.37	3.3552	95.429	82.794
440.00	2.0000	34774	1020.8	.24433	2402.3	2214.1	832.65	.46398	1523.9	1362.2	637.38	2.7066	417.71	352.03
441.00	2.0000	19786	140.00	.68110	4121.7	3984.4	126.87	.26257	1806.5	1642.6	183.97	.96195	107.94	70.248
442.00	2.0000	19246	118.09	.91647	3154.5	3146.9	136.48	.97236	1462.9	1383.4	211.16	2.7331	96.765	50.055

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 2

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
443.00	2.0000	18420	154.91	.45320	3400.9	3228.8	166.43	.19454	1696.8	1525.3	228.78	4.8071	107.37	70.670
444.00	2.0000	21852	156.56	1.9794	2650.1	2464.2	141.75	.75939	972.69	857.27	198.21	-0.	116.93	55.403
445.00	2.0000	11947	107.63	.15597	1892.9	1676.5	173.19	1.1662	793.97	666.47	167.29	2.6329	67.777	27.487
446.00	2.0000	5948.0	159.57	.25112	3126.1	2953.0	309.66	2.3075	1714.7	1575.5	432.49	6.3858	84.819	54.238
447.00	2.0000	12142	172.89	.51353	3341.1	3220.9	140.27	1.1291	615.30	528.27	116.67	1.0360	89.947	61.469
448.00	2.0000	15251	144.01	.11197	3995.0	3641.8	205.93	2.0116	1832.4	1320.2	221.13	3.7838	77.379	55.323
ESTIMATE OF MEAN			130.82	.82251	2786.8	2638.7	155.02	.80336	1584.3	1447.9	194.95	2.8210	191.45	149.33
ESTIMATE OF STANDARD DEVIATION			92.409	1.1079	838.99	863.68	87.088	1.0983	661.50	642.32	109.88	2.3629	109.67	259.67
DEGREES OF FREEDOM			135	135	132	127	135	135	132	127	135	134	132	127
T VALUE			16.509	8.6577	38.307	34.566	20.759	9.1357	27.620	25.503	20.691	13.872	20.133	6.5065

44

TABLE 1
SUMMARY OF TEST DATA

FLEET 3 TEST 3

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-

CAR NO	TEST NO	MILEAGE	HC D1	CO D1	NOX D1	NOXP D1	HC D2	CO D2	NOX D2	NOXP D2	HC D3	CO D3	NOX D3	NOXP D3
301.00	3.0000	10582	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
302.00	3.0000	10044	74.464	.36282	1463.7	1351.0	169.24	.17922	1421.7	1292.4	197.66	.16048	432.76	302.40
303.00	3.0000	9545.0	75.924	.57751	2130.6	2095.7	62.942	.22221	1277.2	1209.5	204.87	.15469	434.94	308.17
304.00	3.0000	11559	145.50	.49910	2673.0	2534.0	85.073	.20715	916.39	808.27	104.65	1.4495	293.33	221.45
305.00	3.0000	9181.0	173.90	.59093	3679.8	3549.3	135.15	.49797	1465.7	1356.6	123.27	1.9908	284.94	224.72
306.00	3.0000	10260	153.17	.37361	3319.6	3193.2	91.435	.16868	1035.4	908.33	98.752	1.5818	215.20	151.68
307.00	3.0000	10162	150.64	.30166	3342.5	3245.3	113.73	.25055	1128.8	1023.6	140.28	2.2124	202.44	141.67
308.00	3.0000	10828	178.36	.34068	3432.2	3315.4	123.27	.28825	1019.6	925.76	160.45	2.6569	162.15	115.10
309.00	3.0000	10712	153.00	.23703	3341.6	3225.0	101.07	.28790	1046.5	960.75	109.94	.09222	258.98	193.40
310.00	3.0000	9488.0	140.97	.36712	2692.9	2582.9	88.261	.17500	819.71	696.85	89.719	.14345	205.08	144.61
311.00	3.0000	9499.0	162.97	.25794	4025.4	3920.7	118.49	.17520	1475.7	1224.7	117.01	.78812	271.99	225.99
312.00	3.0000	8849.0	156.54	.27149	3890.0	3787.9	102.91	.24582	1126.3	1000.8	107.36	1.2744	250.70	202.38
313.00	3.0000	10032	145.55	.36883	2695.8	2652.1	99.594	.22288	832.54	766.42	108.46	.08606	264.51	215.55
315.00	3.0000	11169	57.708	.21741	1450.2	1424.0	160.05	.19224	1309.0	1277.4	339.67	3.0200	190.38	64.362
316.00	3.0000	11132	65.356	.61112	1608.2	1614.2	134.39	.16065	1280.8	1279.1	213.19	1.3420	141.81	121.48
317.00	3.0000	12206	136.43	.78997	2148.6	2081.1	196.61	.22586	1923.7	1866.6	247.12	.92066	246.29	205.96
318.00	3.0000	10831	154.63	.30368	2440.7	2305.3	239.46	.22816	1899.9	1729.2	292.15	.84792	365.30	165.05
320.00	3.0000	3905.0	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
321.00	3.0000	11084	133.23	.71535	3290.0	3227.6	220.26	2.7543	1351.2	1180.6	302.55	5.0808	165.52	94.353
322.00	3.0000	24186	102.55	1.1999	2859.2	2749.4	133.56	.95108	1650.7	1735.2	164.93	.77825	345.48	280.28
323.00	3.0000	7321.0	96.641	.88147	2923.1	2926.3	99.594	.15561	2361.9	2315.3	126.24	3.3639	127.02	100.37
325.00	3.0000	17225	87.791	.95947	1984.9	1895.4	187.37	.57272	2429.0	2503.7	262.77	7.2757	67.690	43.112
326.00	3.0000	13197	78.063	.16709	4088.4	3934.1	102.85	.17335	1797.6	1588.3	139.49	1.7036	134.58	91.915
329.00	3.0000	13654	66.238	.27781	2308.0	2339.0	127.57	.16516	2142.3	2187.1	254.36	1.8225	261.38	198.76
330.00	3.0000	19431	95.594	.19313	2945.0	2892.5	128.88	.38680	1707.3	1715.9	91.276	1.0206	395.12	337.48
334.00	3.0000	14999	95.086	1.2202	3587.9	3731.3	113.99	.75257	2719.3	2761.8	162.26	3.6185	132.78	86.308
336.00	3.0000	5791.0	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
ESTIMATE OF MEAN			120.01	.50356	2846.7	2773.9	130.66	.40164	1516.6	1430.0	173.27	1.8750	244.02	181.02
ESTIMATE OF STANDARD DEVIATION			38.812	.30992	765.84	773.60	44.210	.54020	530.13	568.05	74.814	1.6638	98.478	87.563
DEGREES OF FREEDOM			23	23	23	23	23	23	23	23	23	23	23	23
T VALUE			15.149	7.9600	17.747	17.565	14.479	3.6424	14.015	12.336	11.346	5.5208	12.078	10.128

85

APPENDIX B

ORTHOGONAL EXPERIMENTS

TABLE 1

SUMMARY OF SUMS OF SQUARES

1972 FEDERAL HOT CYCLE

Vehicle No.	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Stability
	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	36.02	0.1504	0.2304	1.085×10^4	62.15	45.70	43.70	0.1984	1.094
702	20.58	0.1780	0.06102	3090	33.55	8.4170	300.8	4.077	7.7340
703	16.11	0.08283	0.1840	2954	45.83*	3.226	169.0	3.802	2.393
704	52.01	1.137	1.381	2432	31.20	27.33	4.468	0.06533	0.1858
705	61.98	0.5672	1.033	7488	34.33	66.15	42.47	1.017	0.7580
706	25.08	0.3437	0.0929	3017	46.21	20.61	18.87	0.3006	0.07220
707	59.12	0.8396	0.3061	1.266×10^4	376.9*	8.779	86.04	0.5030	1.248
708	347.0	5.762*	0.6520	4.654×10^4	270.8	201.1	6.428	0.1200	0.1731
	NO_X CONTROLLED VEHICLES								
801	11.39	0.1281	0.1142	1.468×10^4	101.3	136.1	96.65	0.3333	0.7434
802	16.09	2.811×10^{-2}	0.1369	4889	14.70*	1.089×10^{-3}	123.3	1.436	1.620
803	10.46	0.1165	8.923×10^{-2}	1.510×10^4	72.86	30.84	39.39	1.076*	0.1029
804	2.386	6.753×10^{-3}	5.488×10^{-2}	3844	32.03	74.72	71.51	0.2441	1.980
805	7.766	1.823×10^{-2}	9.235×10^{-2}	5082	79.72*	0.7491	16.70	4.186×10^{-2}	0.09929
806	16.55	5.131×10^{-2}	8.137×10^{-2}	1.070×10^4	40.33	17.23	107.7	0.1317	0.4824
807	84.95	0.3726	9.403×10^{-2}	1.348×10^4	48.62	63.90	86.22	0.6207	0.1291
808	9.471	1.479×10^{-2}	8.467×10^{-3}	707.4	2.922	4.347	66.18	0.1847	0.2202
809	18.43	2.507×10^{-2}	0.3870	6660	12.02	58.08	202.5	0.2533	0.2224

*Values are significantly different at the 95 percent confidence level.

TABLE 1

SUMMARY OF SUMS OF SQUARES

7-MODE MASS EMISSIONS

Vehicle	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Statility
No.	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	118.0	0.4633	1.646	$2.137\text{x}10^{4}$	71.49	30.71	48.44	0.06264	0.3036
702	43.14	0.5553	0.4959	5073	7.006	19.80	254.6	0.6604	1.464
703	33.42	1.278	0.3457	3109	39.65	8.032	49.55	0.5694	0.4436
704	35.88	0.5606	2.199	3152	35.57	35.48	7.173	0.1092	0.1232
705	108.9	0.7990	0.7340	9134	26.26	53.58	73.81	1.928	0.8080
706	32.76	0.4506	0.2790	3753	29.47	79.66	6.612	0.06109	0.1310
707	187.3	0.4450	0.4261	$1.283\text{x}10^{4}$	315.0	46.10	43.41	0.4102	0.5921
708	263.8	2.416	0.6952	$3.125\text{x}10^{4}$	262.4	216.7	17.16	0.4300	0.1563
	NO_X CONTROLLED VEHICLES								
801	18.49	$7.112\text{x}10^{-2}$	0.2238	$1.287\text{x}10^{4}$	24.81	23.03	77.66	.4331	0.1572
802	19.58	$7.202\text{x}10^{-2}$	0.0057	4368	3.811*	$3.00\text{x}10^{-4}$	57.10	0.6121	1.060
803	24.15	0.1022	0.3426	$1.906\text{x}10^{4}$	44.16	116.8	22.50	0.2197	0.9670
804	20.29	$5.405\text{x}10^{-2}$	0.2294	1978	6.672	85.84	46.20	$9.197\text{x}10^{-2}$	0.7876
805	25.18	$7.534\text{x}10^{-2}$	$9.670\text{x}10^{-2}$	4530	49.16 *	3.210	15.61	$4.847\text{x}10^{-2}$	$8.623\text{x}10^{-2}$
806	17.43	$7.022\text{x}10^{-2}$	$1.963\text{x}10^{-2}$	$3.341\text{x}10^{4}$	83.49*	7.222	126.8	0.1325	0.1256
807	159.7	0.2756	$1.656\text{x}10^{-2}$	9036	34.23	37.02	86.02	0.2231	0.3279
808	4.275	$2.608\text{x}10^{-2}$	0.0321	581.3	2.514	2.554	38.03	$9.352\text{x}10^{-2}$	0.0477
809	23.95	$5.859\text{x}10^{-2}$	0.3640	9494	39.12	11.47	128.8	0.4771	0.1530

*Values are significantly different at the 95 percent confidence level.

TABLE 1

SUMMARY OF SUMS OF SQUARES

EPA SHORT CYCLE

Vehicle	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Stability
No.	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	47.83	0.05506	0.3944	7822	39.95	39.21	15.81	0.03097	0.01170
702	20.98	0.1765	0.02430	4231	11.03	2.539	155.3	1.486	2.399
703	20.29	0.2452	0.06250	2879	26.62*	1.02×10^{-3}	59.20	0.5688	0.8501
704	42.69	0.9517	0.4970	3169	116.4	24.60	3.249	0.07960	0.07784
705	41.27	0.1842	0.1547	6785	12.08	26.20	19.89	0.2600	0.1484
706	13.78	0.2926	0.5908	2669	21.56	55.83	10.20	0.1798	0.2119
707	115.6	0.7691	0.1308	9142	217.0*	15.08	41.09	0.2262	0.6688
708	469.4	4.647	0.7848	5.024×10^{4}	518.8	279.2	4.476	0.09683	0.1474
	NO_X CONTROLLED VEHICLES								
801	10.28	6.494×10^{-2}	0.1604	8599	37.95	35.56	24.21	9.306×10^{-2}	0.04367
802	12.96	6.361×10^{-2}	5.800×10^{-2}	4551	7.702*	0.0100	40.13	0.6490	1.434
803	10.22	3.519×10^{-2}	8.003×10^{-2}	7464	108.2*	17.52	9.923	0.2539	0.2587
804	8.643	0.1078	2.293×10^{-2}	1222	2.753	13.02	30.86	0.1393	1.208
805	8.882	0.1458*	9.233×10^{-3}	3518	95.73	5.623	4.746	0.1058	0.02470
806	17.56	7.228×10^{-2}	2.749×10^{-2}	6676	13.20	2.996	62.93	0.2718	0.2427
807	128.2	0.3127	0.3566	8000	65.36	70.39	67.47	0.9812*	0.1726
808	4.053	9.359×10^{-3}*	1.400×10^{-3}	937.5	2.901	0.6284	58.81	0.5792*	1.724×10^{-2}
809	20.21	7.422×10^{-2}	0.3227	4951	14.86	3.234	69.92	0.1152	0.1220

*Values are significantly different at the 95 percent confidence level.

TABLE 1

SUMMARY OF SUMS OF SQUARES

DIAGNOSTIC 1 (49/45 MPH CRUISE)

Vehicle No.	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Stability
	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	$6.3030x10^{4}$	229.9	284.3	1.812	0.04504	0.0858	$1.1616x10^{7}$	$4.7595x10^{4}$	27093.2
702	$3.8652x10^{4}$	212.8	252.8	$4.5576x10^{-3}$	$15.71x10^{-5}$	$9.158x10^{-5}$	$3.1306x10^{7}$	$1.4001x10^{5}$	$1.092x10^{5}$
703	$6.7491x10^{4}$	1590	1362.3	16.71	0.6465	0.7106	$1.7734x10^{7}$	$6.5272x10^{4}$*	$5.295x10^{5}$
704	$9.0401x10^{4}$	775.9	576.5	2.503	0.03575*	0.0030	$4.8348x10^{6}$	$5.7292x10^{4}$	26406.2
705	$1.0526x10^{6}$	$4.9368x10^{4}$*	932.2	37.12	0.06247	0.0883	$2.2498x10^{7}$	$2.3190x10^{4}$*	2631.0
706	$1.1285x10^{5}$	1243*	81.67	20.65	0.6153	0.1443	$1.3880x10^{7}$	$1.5487x10^{5}$*	17792.0*
707	$3.5499x10^{4}$	858.1	210.8	5.578	0.1233	0.0520	$4.5076x10^{6}$	$4.0371x10^{4}$	$1.279x10^{4}$
708	$3.5718x10^{4}$	560.5	289.3	3.076	0.01590	0.0279	$3.8331x10^{6}$	8763	$1.891x10^{4}$
	NO_X CONTROLLED VEHICLES								
801	$5.478x10^{4}$	108.9	181.3	10.42	$5.921x10^{-2}$	$9.425x10^{-3}$	$1.513x10^{7}$	$1.723x10^{4}$	5318
802	$3.041x10^{4}$	88.20	25.31	0.2294	$8.562x10^{-3}$	$1.70x10^{-4}$	$2.039x10^{7}$	$1.241x10^{5}$	15155
803	$5.032x10^{4}$	130.9	201.2	3.636	$5.591x10^{-2}$	$4.09x10^{-2}$	$1.173x10^{7}$	4540	24247
804	$1.465x10^{4}$	39.68	68.30	6.780	$5.847x10^{-2}$	$1.147x10^{-2}$	$2.294x10^{7}$	$7.467x10^{4}$	80380
805	$3.314x10^{4}$	35.40	304.1	1.361	$3.236x10^{-2}$	$1.003x10^{-2}$	$9.090x10^{6}$	$3.501x10^{4}$	1489
806	$1.922x10^{4}$	104	118.0	172.1	1.276*	$1.522x10^{-2}$	$4.204x10^{7}$	$7.087x10^{4}$	77562
807	$7.900x10^{4}$	621.1	234.9	7.783	$4.846x10^{-2}$	$1.50x10^{-3}$	$1.981x10^{7}$	$6.820x10^{4}$	45967
808	$5.563x10^{4}$	48.7	117.49	$4.744x10^{-2}$	$5.122x10^{-4}$	$1.58x10^{-4}$	$7.530x10^{7}$	$2.817x10^{4}$	$2.083x10^{4}$
809	$4.455x10^{4}$	28.75	$1.81x10^{3}$	5.757	$5.437x10^{-2}$	0.0364	$3.833x10^{7}$	$5.053x10^{4}$	$1.64x10^{5}$

*Values are significantly different at the 95 percent confidence level.

TABLE 1
SUMMARY OF SUMS OF SQUARES
DIAGNOSTIC 2 (33/30 MPH CRUISE)

Vehicle	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Stability
No.	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	$8.5992x10^{4}$	461.1	1015.7	1.419	$3.606x10^{-2}$	0.2016	$4.1823x10^{6}$	$4.2048x10^{4}$	64363.7
702	$5.6257x10^{4}$	470.1	367.5	$5.4943x10^{-2}$	$3.621x10^{-4}$	$1.588x10^{-4}$	$1.9929x10^{7}$	$2.0714x10^{5}$	$2.917x10^{4}$
703	$1.1901x10^{5}$	2970	660.0	.7290	$5.431x10^{-3}$	0.0052	$1.0281x10^{7}$	$8.2827x10^{4}$	56074.2
704	$2.8122x10^{5}$	5988	9498.4	7.435	.1675	0.1980	$1.1247x10^{6}$	$2.8320x10^{4}$	55037.2
705	$8.4124x10^{4}$	501.8	674.2	17.08	.1116	0.5144	$4.6643x10^{6}$	$2.0511x10^{4}$	44483.0
706	$1.5804x10^{5}$	3906	930.7	11.77	.1440*	0.0017	$9.4200x10^{6}$	$7.4864x10^{4}$	25469.0
707	$7.8590x10^{4}$	711.4	213.7	8.848	.3162	0.2995	$1.0669x10^{7}$	$8.2252x10^{4}$	$8.185x10^{4}$
708	$1.0586x10^{5}$	2661	1008	47.37	1.144*	0.0720	$1.0926x10^{6}$	$2.0918x10^{4}$	3970.0
	NO_X CONTROLLED VEHICLES								
801	$6.596x10^{4}$	154.1	777.7	7.188	$4.791x10^{-2}$	$3.237x10^{-2}$	$1.271x10^{7}$	$2.937x10^{4}$	10181
802	$4.257x10^{4}$	495.9*	27.86	1.504	$5.115x10^{-2}$	$1.70x10^{-4}$	$1.168x10^{7}$	$1.146x10^{5}$	15015
803	$4.573x10^{4}$	497.2	880.6	10.01	0.6357*	$3.97x10^{-2}$	$7.00x10^{6}$	$7.44x10^{4}$*	5299
804	$1.836x10^{4}$	33.88	30.34	0.1841	$3.719x10^{-3}$	$8.70x10^{-4}$	$1.581x10^{7}$	$4.757x10^{4}$	62194
805	$3.578x10^{4}$	66.26	390.1	1.503	$2.882x10^{-2}$	$2.633x10^{-3}$	$4.904x10^{6}$	$4.402x10^{4}$	8562
806	$3.442x10^{4}$	131.3	99.58	0.6597	$9.378x10^{-3}$	$1.167x10^{-3}$	$1.613x10^{7}$	$5.218x10^{4}$	57834
807	$1.005x10^{5}$	562.3	487.6	18.27	0.1564	$4.40x10^{-3}$	$6.356x10^{6}$	$2.714x10^{4}$	30428
808	$2.519x10^{5}$	3590*	75.96	14.25	0.1067	0.102	$7.298x10^{6}$	$2.631x10^{4}$	$5.75x10^{4}$
809	$6.855x10^{4}$	51.16	60.11	0.1840	$3.560x10^{-3}$	$2.0x10^{-5}$	$2.328x10^{7}$	$2.253x10^{4}$	$8.20x10^{4}$

*Values are significantly different at the 95 percent confidence level.

TABLE 1

SUMMARY OF SUMS OF SQUARES

DIAGNOSTIC 3 (IDLE)

Vehicle	HC (gm/mile)			CO (gm/mile)			NO_x (gm/mile)		
	Analysis of Variance		Stability	Analysis of Variance		Stability	Analysis of Variance		Stability
No.	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance	Sums of Sq.	Residual	Variance
	PRE-EMISSION CONTROLLED VEHICLES								
701	1.5139×10^{6}	4698	6632	54.07	7.5060×10^{-2}	0.2959*	4.0231×10^{4}	606.5*	68.89
702	5.6644×10^{5}	6188*	390.8	47.10	.1177	0.2054	3.8145×10^{4}	883.2	1508
703	1.9404×10^{6}	2.0195×10^{4}	5499.7	36.43	9.0279×10^{-2}	0.6496	9192	174.7	299.3
704	1.1215×10^{6}	6142	729.5	72.21	8.0450×10^{-2}	0.1624	4385	58.71	49.00
705	1.9852×10^{6}	8909	3824	61.18	9.6675×10^{-2}	0.3206	7426	383.4	96.00
706	8.3262×10^{5}	5545*	622.2	44.08	.1473	0.0677	3262	65.20	209.0
707	9.9472×10^{5}	2190	3414	50.63	.2845	1.000	3.7734×10^{4}	1026	1724
708	4.2220×10^{6}	7.9624×10^{4}	1248	37.41	.1935	0.1761	5044	52.23	38.22
	NO_X CONTROLLED VEHICLES								
801	1.400×10^{5}	54.21	86.49	84.86	2.697×10^{-2}	4.222×10^{-2}	5.802×10^{4}	889.9*	90.70
802	1.095×10^{6}	1.536×10^{4}	36.72	36.25	8.594×10^{-2}	2.60×10^{-2}	1.716×10^{6}	4583*	616.5
803	3.874×10^{4}	287.3	70.46	30.16	4.541×10^{-2}	1.3×10^{-3}	1.165×10^{5}	1964	495.6
804	1.788×10^{5}	2376*	143.9	63.32	0.1103	0.4093	9.236×10^{4}	1120	250.2
805	7.147×10^{4}	273	661.5	27.93	5.041×10^{-2}*	7.60×10^{-3}	2.186×10^{5}	1582	430.6
806	1.395×10^{6}	1.324×10^{4}	144.8	54.93	5.657×10^{-2}	4.31×10^{-2}	6.321×10^{5}	1426	984.6
807	3.881×10^{6}	3.092×10^{4}*	178.2	50.91	5.392×10^{-2}	3.95×10^{-2}	4.883×10^{5}	4825	227.8
808	9.748×10^{5}	2340	581.1	16.24	0.1695	0.1162	6599	31.22	110.5
809	4.077×10^{5}	2294	1.056×10^{3}	45.22	7.221×10^{-2}	6.68×10^{-2}	1.9787×10^{6}	9190	1.886×10^{3}

*Values are significantly different at the 95 percent confidence level.

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 701
1967 Chevrolet Malibu

1972 Federal Hot Cycle — EPA Short Cycle — 7-Mode Cycle

Effect	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	- 6	+11	1.479	99.9	-28.76	99.9	2.040	99.9	1.869	99.9	-12.14	99.9	1.255	99.9	1.388	99.9	-40.57	99.9	2.470	99.9
B=Idle, rpm	400	550	-.9453	99.9	8.549	97.5	.0095	<50	-.8693	99.9	11.40	99.9	.0669	65	-2.394	99.9	13.81	99.5	.0793	55
C=PCV	Clsd.	Open	.1277	50	- 6.444	90	.4609	97.5	.0640	<50	- 3.169	70	.2011	99.5	.9979	99.5	.8916	<50	.3853	99.5
D=Air Cl, in H_2O	4.7	2.0	-.0235	<50	-10.48	99.5	-.4207	95	-.1350	75	1.349	<50	-.2959	99.5	.0513	<50	-12.80	99.5	-.0804	55
E=Idle CO, %	5.3	6.3	.5956	99.5	9.411	95	-.7220	99	.2954	95	7.709	95	-.3131	99	.5929	90	8.235	90	-.7559	99.9
E=Idle Co, %	6.3	8.8	1.199	99.5	17.32	99.9	.0683	<50	1.567	99.9	27.14	99.9	-.09363	70	2.525	99.9	29.88	99.9	.1198	65
AB=CD			-.2405	<50	- 5.273	75	.1900	65	-.0780	55	- 2.034	55	.3348	99.5	.7886	97.5	- 4.677	70	.4294	99.5
AC=BD			.0788	<50	- 2.863	50	.4574	97.5	.0620	<50	- .4198	<50	.2306	99	-.1658	<50	- 2.565	<50	.5344	99.9
AD=BC			-.4923	99	10.07	99	-.6939	99.5	-.5823	99.9	- .3244	<50	-.4624	99.9	-.8001	97.5	14.90	99.9	-.6853	99.9
AE_1			.1101	<50	- 1.190	<50	-.8473	99.5	-.2371	90	.8017	<50	-.4154	99.9	-.3126	60	3.074	<50	-.6099	99.9
AE_2			.0961	<50	- 1.985	<50	-.0427	<50	.5982	99.9	- 4.736	80	-.1694	90	.6721	90	-11.11	97.5	.1865	80
BE_1			-.3876	90	- .5711	<50	.4310	90	-.2464	90	1.779	<50	.1556	90	-.8121	95	- 2.903	<50	.1421	70
BE_2			.2524	<50	4.607	65	-.2030	60	.3272	97.5	4.716	80	-.2521	97.5	-.0514	<50	6.412	75	-.2070	75
CE_1			.0276	<50	- 5.124	70	-.1815	55	.3884	99	.9520	<50	.1249	80	.3689	65	.9167	<50	.1984	75
CE_2			.1321	<50	2.382	<50	-.0498	<50	-.0748	<50	2.544	55	.0046	<50	.7584	[illegible]	1.051	<50	-.1215	65
DE_1			.1164	<50	2.115	<50	.5207	95	.1431	70	2.704	55	.2984	99	.3909	70	.3355	<50	.2759	95
DE_2			.1539	<50	- 1.040	<50	.3270	80	-.4063	99	- 5.526	90	-.0941	70	-.2541	<50	- 6.043	75	-.0390	<50

Diagnostic 1 (49/45 MPH Cruise) — Diagnostic 2 (33/30 MPH Cruise) — Diagnostic 3 (Idle)

Effect	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	- 6	+11	98.30	99.9	.1535	90	1327	99.9	112.4	99.9	-.05344	<50	736.8	99.9	358.6	99.9	.2538	95	25.61	90
B=Idle, rpm	400	550	-1.894	<50	.0503	<50	-14.63	<50	-13.36	75	.08324	65	-64.59	<50	-266.3	99.9	-.1566	75	16.26	80
C=PCV	Clsd.	Open	1.034	<50	-.1383	80	28.38	<50	- 6.268	<50	-.2394	99	1.079	<50	35.42	75	-.07003	<50	-23.08	90
D=Air Cl, in H_2O	4.7	2.0	.3737	<50	-.2728	99.5	69.07	<50	2.795	<50	.1230	75	-57.17	<50	- 3.644	<50	8.338×10^{-3}	<50	- 6.379	<50
E=Idle CO, %	5.3	6.3	3.314	<50	5.582×10^{-3}	<50	-35.73	<50	6.243	<50	-.03711	<50	10.43	<50	68.89	75	.8355	99.9	1.096	<50
E=Idle Co, %	6.3	8.8	3.063	<50	.02670	<50	-66.78	<50	10.60	60	.2763	99	-188.9	80	107.5	99	2.613	99.9	-54.81	99
AB=CD			-1.641	<50	-.1322	80	55.06	<50	- 2.433	<50	-.1253	80	-18.54	<50	-102.8	99.9	-.05292	<50	30.28	90
AC=BD			10.32	80	-.0699	55	109.9	55	.7678	<50	-.01294	<50	42.60	<50	3.981	<50	-.09461	55	7.229	<50
AD=BC			8.836	65	.2320	97.5	-131.4	65	- 2.697	<50	.06641	55	-147.5	80	- 60.80	99.9	.01925	<50	2.088	<50
AE_1			4.050	<50	.0905	55	21.72	<50	.03764	<50	-.03701	<50	-19.56	<50	9.960	<50	.1107	55	- 3.741	<50
AE_2			.6790	<50	.0203	<50	-117.5	<50	.04901	<50	.07332	<50	-109.6	60	99.33	99	-.03828	<50	-10.02	55
BE_1			1.909	<50	.0726	<50	-88.38	<50	-18.09	80	.03970	<50	-122.7	65	-68.00	90	-.04191	<50	-16.25	75
BE_2			12.53	80	.0031	<50	5.750	<50	23.05	95	.05931	<50	-30.24	<50	25.25	55	.3614	97.5	-11.22	60
CE_1			2.750	<50	-.1442	75	63.83	<50	8.483	<50	.07720	50	2.983	<50	52.51	75	.1100	55	-16.92	75
CE_2			1.245	<50	-.0822	50	15.27	<50	- 6.710	<50	-.1308	70	5.716	<50	- 2.546	<50	.2026	75	12.90	65
DE_1			5.023	<50	.0963	60	-26.32	<50	8.914×10^{-3}	<50	.1136	65	-62.96	<50	27.13	60	.1497	65	12.43	65
DE_2			9.492	70	.0119	<50	6.669	<50	15.56	75	.02070	<50	42.78	<50	-43.90	80	-.1954	75	[illegible]	65

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 702
1964 Ford Galaxie

			1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
Effect	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	0	17	1.307	99.9	-5.737	95	5.438	99.9	1.130	99.9	-7.648	99.9	4.521	99.9	1.119	99.9	11.48	99.9	6.172	99.9
B=Idle, rpm	400	550	-.1133	<50	9.303	99.5	- .1833	<50	.07333	<50	12.46	99.9	-.3958	<50	-.5308	90	15.09	99.9	-.1075	<50
C=PCV	Clsd.	Open	-.2000	65	-4.867	90	-1.000	65	-.6233	95	-7.409	99.9	-.5008	55	-.3842	75	-4.358	99.5	-.2375	<50
D=Air Cl, in H_2O	7.7	0.75	-.3733	95	-7.030	99	- .7383	50	-.3567	90	-5.366	99.5	-.7342	70	-.5562	90	- 3.211	99.9	-.1042	<50
E=Idle CO, %	3.8	4.8	.1575	<50	5.325	90	-1.904	90	.2650	65	4.661	97.5	-.5875	55	.2288	[illegible]	1.524	60	-.4525	65
E=Idle Co, %	4.8	7.3	.8575	99.5	12.20	99.9	3.214	99.5	.9737	99.9	17.45	99.9	1.101	80	1.755	99.9	20.27	99.9	1.032	97.5
AB=CD			-.3283	90	-4.175	90	- .3683	<50	-.1867	55	-2.849	90	-.4242	<50	-.3925	75	-5.154	99.9	-.5492	80
AC=BD			-5.000×10^{-3}	<50	2.548	70	- .1150	<50	-.06000	<50	3.202	95	-.2358	<50	-.07583	<50	.7192	<50	.1708	<50
AD=BC			-.2383	70	-2.355	65	.1967	<50	.06333	<50	.6892	<50	-.05583	<50	-.1725	<50	1.056	55	-.3625	65
AE_1			.3350	75	1.308	<50	- .2688	<50	.2325	55	- .8888	<50	-.1700	<50	.4187	70	- .1538	<50	-.2800	<50
AE_2			-.2250	60	-4.223	80	1.491	70	-.07125	<50	-1.298	<50	.2812	<50	-.1375	<50	- .9563	<50	.1625	<50
BE_1			-.1125	<50	3.935	75	-1.274	65	-.1025	<50	.3313	<50	-.7750	65	-.2338	<50	.2762	<50	-.8850	95
BE_2			.2575	65	1.510	<50	.5587	<50	.6337	99	2.465	75	.2512	<50	.7775	95	1.461	65	.2475	<50
CE_1			.01250	<50	- .4625	<50	.3188	<50	-.1025	<50	.6137	<50	-.09750	<50	-.1163	<50	1.351	60	-.2150	<50
CE_2			.08000	<50	3.292	70	- .1163	<50	.1737	<50	1.267	<50	.1712	<50	.06500	<50	.8487	<50	.02500	<50
DE_1			-.4300	90	-2.575	60	-1.026	60	-.3025	70	-1.146	<50	-.9475	75	-.5637	80	.3312	<50	-1.625	99.9
DE_2			.5175	95	2.270	55	2.261	95	.2087	50	1.860	65	1.086	80	.5250	80	- .2438	<50	1.455	99.5

			Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
Effect	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	0	17	70.57	99.9	-9.340×10^{-3}	90	2101	99.9	76.93	99.9	-0.01594	90	1436	99.9	210.5	99.9	-.1573	60	24.94	90
B=Idle, rpm	400	550	- 1.596	<50	-2.021×10^{-3}	<50	131.4	55	- 8.521	60	-2.804×10^{-3}	<50	91.54	<50	-126.5	99.9	-.1215	<50	19.30	80
C=PCV	Clsd.	Open	-24.67	99.9	-.01107	95	-560.5	99.5	-37.94	99.9	- .08653	99.9	-731.7	99.9	17.31	<50	.07523	<50	7.472	<50
D=Air Cl, in H_2O	7.7	0.75	-11.98	90	8.071×10^{-3}	80	-130.0	50	-21.24	95	4.010×10^{-3}	<50	-244.1	65	- 36.76	65	-.07927	<50	- 1.887	<50
E=Idle CO, %	3.8	4.8	-10.30	70	-9.457×10^{-3}	80	-246.6	70	- 4.991	<50	- .02000	95	-270.2	65	66.19	80	1.101	99.9	-27.32	90
E=Idle Co, %	4.8	7.3	13.31	80	-1.907×10^{-3}	<50	312.1	80	17.55	80	4.286×10^{-3}	<50	258.3	60	67.88	80	2.181	99.9	-36.95	97.5
AB=CD			- 3.732	<50	-6.391×10^{-3}	70	- 58.61	<50	- 4.666	<50	- .01443	90	- 63.74	<50	- 44.52	70	-.1026	<50	5.756	<50
AC=BD			.05417	<50	4.580×10^{-3}	60	67.90	<50	.4939	<50	6.925×10^{-3}	55	- 26.28	<50	- .2669	<50	-.05753	<50	11.84	60
AD=BC			- 1.856	<50	-3.717×10^{-3}	<50	- 89.[illegible]	<50	- 9.141	60	5.166×10^{-3}	<50	-176.6	55	- 59.41	90	-.2141	75	-10.39	55
AE_1			- 1.712	<50	-1.760×10^{-3}	<50	- 8.123	<50	- .1509	<50	.01359	75	-131.2	<50	47.65	65	.1026	<50	2.496	<50
AE_2			1.773	<50	-4.159×10^{-3}	<50	- 1.245	<50	.9085	<50	- .01669	80	185.4	<50	- 10.12	<50	.1155	<50	-25.63	90
BE_1			- 9.716	65	5.054×10^{-3}	55	-248.3	70	-14.58	70	5.383×10^{-4}	<50	-402.3	80	- 46.43	65	-.1378	<50	-10.76	<50
BE_2			10.10	70	3.982×10^{-3}	<50	69.92	<50	21.46	90	.01164	70	294.1	65	72.80	90	.2489	70	- 1.254	<50
CE_1			- 5.216	<50	-5.594×10^{-3}	60	-275.4	75	-12.95	70	-2.685×10^{-3}	<50	-272.1	65	3.792	<50	-.1936	65	25.52	90
CE_2			- .08004	<50	-2.298×10^{-3}	<50	158.6	50	8.252	<50	5.112×10^{-3}	<50	113.1	<50	- 37.15	55	-.09311	<50	-17.55	70
DE_1			-10.52	70	-7.736×10^{-4}	<50	-279.1	75	-11.33	65	7.480×10^{-4}	<50	-221.9	55	- 22.08	<50	-.04515	<50	-14.00	60
DE_2			12.62	75	-3.630×10^{-3}	<50	377.6	90	15.86	75	-3.640×10^{-3}	<50	295.5	65	27.29	<50	-.04292	<50	11.90	55

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 703
1965 Dodge Dart

Effect	Increment		1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
			HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	0	17	1.246	99.9	-4.532	70	3.771	99.9	1.139	99.9	-2.013	60	2.484	99.9	.9400	90	-2.929	65	2.373	99.9
B=Idle, rpm	400	550	-.1725	70	8.133	99	-.1142	<50	-.1692	<50	9.434	99.9	.1692	<50	-.2283	<50	7.669	99	.2833	60
C=PCV	Clsd.	Open	-.02917	<50	-5.682	80	-.2375	<50	.04417	<50	-5.593	97.5	.3875	65	.6367	70	-6.418	97.5	.5383	90
D=Air Cl, in H_2O	4.8	0.6	-.05083	<50	.7867	<50	.09750	<50	-.1275	<50	.9708	<50	.3358	60	-.2917	<50	-.5292	<50	.2617	55
E=Idle CO, %	4.3	5.3	-.08000	<50	-1.974	<50	[illegible]	<50	.1288	<50	1.149	<50	-1.157	99	.3488	<50	1.131	<50	-.0888	95
E=Idle Co, %	5.3	7.8	.9312	99.9	18.44	99.9	[illegible]	<50	1.002	99.9	17.00	99.9	.6500	80	.5162	55	16.14	99.9	.3587	65
AB=CD			-8.333×10^{-4}	<50	-2.835	55	.7032	<50	-.07750	<50	.05917	<50	-2.500×10^{-3}	<50	.3533	<50	-.4108	<50	.1217	<50
AC=BD			.2525	95	1.733	<50	-1.154	70	.2592	70	-4.167×10^{-3}	<50	-4.167×10^{-3}	<50	.5950	70	-.9842	<50	.1367	<50
AD=BC			.07083	<50	.3683	<50	1.337	75	-.1625	<50	.5658	<50	.6242	90	-.1000	<50	2.031	<50	.3133	65
AE_1			7.500×10^{-3}	<50	.3462	<50	-.6937	<50	-.1913	<50	1.844	<50	- .9650	97.5	.05375	<50	3.239	60	-.6538	90
AE_2			.3687	97.5	-1.629	<50	1.017	60	.6775	97.5	-3.384	70	.9275	95	-.01375	<50	-4.388	70	.6338	75
BE_1			-.09000	<50	.4212	<50	-.5362	<50	-.08125	<50	.3662	<50	- .1825	<50	-.2363	<50	1.084	<50	-.1188	<50
BE_2			-.01125	<50	.7038	<50	.4625	<50	-.2225	55	-1.206	<50	.2400	<50	.6287	65	-3.740	65	.5762	80
CE_1			-.03500	<50	1.196	<50	.2512	<50	-.1437	<50	4.134	80	- .4650	65	-.3538	<50	5.461	80	-.6587	90
CE_2			.2287	70	-.2013	<50	-1.080	60	.3950	75	-4.259	80	.4800	65	1.179	95	-3.062	55	.2012	<50
DE_1			-.04250	<50	2.871	<50	1.864	90	.03125	<50	5.666	95	.5475	70	-.3188	<50	9.161	97.5	.2112	<50
DE_2			8.750×10^{-3}	<50	-.7038	<50	-.6000	<50	-.3700	75	-1.866	<50	.02750	<50	-.1487	<50	-3.625	65	3.750×10^{-3}	<50

Effect	Increment		Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
			HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	0	17	67.05	99.9	.09840	<50	1172	99.9	94.59	99.9	.02155	<50	1050	99.9	380.2	99.9	.3726	99	6.885	60
B=Idle, rpm	400	550	-22.83	70	-.3501	65	322.0	99	-26.20	75	-.01913	<50	27.35	<50	-260.6	99.9	.06196	<50	12.38	95
C=PCV	Clsd.	Open	.9257	<50	.6445	90	-553.8	99.9	-25.19	65	-.2915	99.9	91.15	<50	55.12	75	-.1897	75	- 4.753	<50
D=Air Cl, in H_2O	4.8	0.6	-34.67	95	-.5430	80	505.7	99.9	-9.415	<50	.04158	75	110.3	50	- 65.25	70	.1077	65	- .6103	<50
E=Idle CO, %	4.3	5.3	-10.48	<50	-.04947	<50	-199.7	80	-38.18	75	-.06746	90	-362.4	97.5	131.0	90	1.209	99.9	- 9.317	65
E=Idle Co, %	5.3	7.8	29.74	70	.4265	65	-34.38	<50	42.20	75	.1171	99	386.9	97.5	67.88	65	1.517	99.9	-16.54	97.5
AB=CD			-3.363	<50	-.3107	60	221.4	95	-24.23	65	-.07322	95	52.09	<50	-118.4	90	-.1905	75	- 2.247	<50
AC=BD			18.33	60	.06027	<50	-214.6	90	11.34	<50	-.03552	70	27.09	<50	111.4	90	.1810	75	6.122	55
AD=BC			6.626	<50	-.4041	70	710.2	99.9	24.05	65	7.967×10^{-3}	<50	266.2	95	- 37.81	<50	-.03620	<50	-1.718	<50
AE_1			-17.27	<50	-.6133	75	128.5	60	-11.19	<50	-.01050	<50	-432.4	99	51.00	55	-.2754	90	-2.048	<50
AE_2			11.79	<50	.4777	70	-79.84	<50	23.59	55	.03065	55	466.2	99	86.54	75	.8942	99.9	.3514	<50
BE_1			17.39	<50	.4458	65	-362.2	97.5	6.906	<50	-.08646	<50	34.58	<50	-128.5	90	-.3214	95	-3.276	<50
BE_2			-27.95	70	-.7525	90	489.0	99.9	-28.31	65	-.03406	60	-9.344	<50	74.91	70	.2024	80	- .3026	<50
CE_1			17.60	<50	.03855	<50	-12.21	<50	18.39	<50	.08631	95	-126.8	<50	3.838	<50	-.2393	75	6.534	<50
CE_2			-2.596	<50	.3576	55	-135.4	65	9.182	<50	-.08555	95	189.1	65	28.95	<50	.2571	90	-4.763	<50
DE_1			29.00	70	.03305	<50	82.87	<50	35.37	70	.06843	90	300.9	90	-106.1	75	-.2593	90	24.23	99.5
DE_2			-16.54	<50	.1343	<50	-56.16	<50	-50.46	90	-.05282	75	-146.4	55	65.33	65	.3133	95	-14.61	80

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 704
1965 Chevrolet Nova

Effect	Increment		1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
			HC		CO		NO$_x$		HC		CO		NO$_x$		HC		CO		NO$_x$	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	-2	15	1.366	99	-.8108	<50	.4875	99.9	1.439	99.5	4.612	65	0.3400	99	0.6425	90	-5.665	95	0.7692	99.9
B=Idle, rpm	400	550	-.9842	95	-5.576	95	.05250	<50	-0.8525	95	-10.07	95	0.04500	<50	-0.4275	75	0.3533	<50	0.1975	70
C=PCV	Clsd.	Open	.5408	65	-7.493	99.5	.3258	99	0.3258	55	-6.995	80	0.3433	99	0.8242	97.5	-11.13	99.9	0.4708	99.5
D=Air Cl, in H_2O	2.5	0.9	-.4058	55	-3.678	80	.1608	70	-0.5292	75	-5.613	70	-0.02833	<50	-0.8358	97.5	-1.105	<50	0.04583	<50
E=Idle CO, %	4.0	5.0	.4900	55	5.402	90	.02125	<50	0.7300	80	-0.6075	<50	-3.750×10^{-3}	<50	0.2850	55	4.816	80	0.1062	<50
E=Idle Co, %	5.0	7.5	1.282	95	10.69	99.5	-.4775	95	0.6675	75	6.159	70	-0.2513	90	1.417	99.5	11.03	99.5	-0.2225	70
AB=CD			.02750	<50	-1.003	<50	.02417	<50	0.3475	60	-1.783	<50	-0.1000	60	0.4508	80	-2.248	60	0.03750	<50
AC=BD			-.1042	<50	2.494	<65	.02417	<50	-0.3708	65	-3.942	60	0.2483	95	-0.2608	60	5.338	95	0.2442	80
AD=BC			.7292	80	4.146	90	.00917	<50	0.5142	75	5.673	70	-6.667×10^{-3}	<50	0.03583	<50	4.033	80	-0.02417	<50
AE$_1$			.4075	<50	3.112	70	-.01875	<50	0.3200	<50	-5.487	65	-0.1038	<50	-0.2125	<50	-1.334	<50	-0.1088	<50
AE$_2$			.6350	<50	.7337	<50	-.02250	<50	0.4050	55	4.749	55	0.1587	70	0.8150	95	5.341	90	0.08750	<50
BE$_1$			-.3425	<50	-1.005	<50	.06875	<50	-0.7425	80	1.632	<50	-0.04375	<50	-0.1225	<50	-0.9462	<50	0.08875	<50
BE$_2$			.2400	<50	6.299	95	-.2725	95	0.6150	75	8.851	80	-0.1112	55	0.2975	55	9.326	99	-0.2525	70
CE$_1$			.06000	<50	-2.850	65	-.07375	<50	0.1050	<50	1.845	<50	0.1688	70	-0.3600	60	-1.476	<50	0.1162	<50
CE$_2$			-.5725	60	1.676	<50	-.08000	<50	-0.1675	<50	1.121	<50	-0.2688	90	0.6900	90	-1.081	<50	-0.04000	<50
DE$_1$			-.8700	<50	2.612	60	-.02125	<50	-0.04750	<50	-0.7600	<50	0.1113	55	0.1300	<50	2.531	55	-0.05625	<50
DE$_2$			-.4675	50	-4.331	80	.01064	<50	-0.6575	75	-1.781	<50	0.1312	60	-0.4225	70	0.4237	<50	-0.01000	<50

Effect	Increment		Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
			HC		CO		NO$_x$		HC		CO		NO$_x$		HC		CO		NO$_x$	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	- 2	15	79.65	99.9	.03980	50	711.2	99.9	134.3	99.9	.3992	95	168.7	97.5	305.0	99.9	-.2571	95	1.564	<50
B=Idle, rpm	400	550	6.944	<50	-.2423	99	13.76	<50	-20.05	<50	-.5331	99.5	- 12.57	<50	-192.0	99.9	-.1453	75	1.174	<50
C=PCV	Clsd.	Open	- 9.193	<50	-.3209	99.9	315.4	99.5	45.69	75	-.1668	<50	199.7	99	48.63	75	.1965	90	5.335	80
D=Air Cl, in H_2O	2.5	0.9	- 6.102	<50	.03533	50	157.7	70	21.31	<50	.06091	<50	91.57	80	- 12.94	<50	.09350	65	- 3.516	65
E=Idle CO, %	4.0	5.0	46.07	99.5	.1430	75	- 14.51	<50	74.83	90	.1848	<50	31.48	<50	106.6	97.5	1.243	99.9	- 6.898	90
E=Idle Co, %	5.0	7.5	-50.04	99.5	.1761	90	-179.6	70	-38.45	60	.1344	<50	-144.2	90	130.3	99.5	2.759	99.9	-19.07	99.9
AB=CD			28.91	97.5	-.07392	60	- 61.60	<50	60.27	90	.1599	<50	- 50.69	60	24.06	<50	.4282	99.5	- 3.185	60
AC=BD			-50.64	99.9	.2845	99.5	- 48.93	<50	-72.34	95	.04097	<50	39.22	<50	- 15.99	<50	.2146	90	- 3.839	70
AD=BC			1.134	<50	.03913	<50	51.04	<50	27.66	55	.4872	99	- 99.08	75	- 10.99	<50	.2715	97.5	- 3.018	60
AE$_1$			- 7.139	<50	.09440	60	-100.5	<50	-40.98	65	-.07054	<50	- 62.42	60	- 4.805	<50	-.4279	99	- 2.834	<50
AE$_2$			- 4.065	<50	-.06481	<50	112.3	<50	37.32	60	.1902	<50	95.71	75	13.60	<50	.1601	75	- 1.932	<50
BE$_1$			-39.60	90	-.1087	65	-100.8	<50	-53.50	70	.1172	<50	-103.9	80	- 56.46	70	.1535	75	- 3.093	50
BE$_2$			7.057	<50	.2194	95	- 35.03	<50	15.00	<50	-.01612	<50	84.81	70	- 22.08	<50	-.4689	99.5	3.640	60
CE$_1$			19.86	70	-.05666	<50	90.64	<50	30.98	<50	-.1293	<50	143.0	90	5.955	<50	-.2538	90	3.322	55
CE$_2$			-12.64	<50	.1042	65	-128.1	55	.3083	<50	.3001	65	-204.7	97.5	.8413	<50	.04997	<50	- 4.158	65
DE$_1$			17.00	65	8.901×10^{-3}	<50	10.03	<50	24.53	<50	.01957	<50	64.89	60	37.22	55	-.04571	<50	- 4.375	65
DE$_2$			.7934	<50	-.1078	65	- 88.32	<50	11.38	<50	-.08848	<50	-158.7	90	26.51	<50	-.1645	80	9.663	97.5

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 705
1963 Dodge Dart

			1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
Effect	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	-7.5	9.5	1.082	99.5	-13.99	99.9	1.315	99.5	.9192	99.9	-8.268	99.9	.7817	99.5	.7350	95	-23.31	99.9	1.981	99.5
B=Idle, rpm	440	600	-.3792	70	5.576	95	-.1833	<50	-.08417	<50	4.755	99	-.2233	65	-.6617	90	8.732	99.5	-.8075	75
C=PCV	Clsd.	Open	-.4175	75	-9.164	99.5	.3233	55	-.06750	<50	-8.275	99.9	.1500	75	6.667×10^{-3}	<50	-6.348	90	-.2392	<50
D=Air Cl, in H_2O	3.6	1.15	-.6292	90	-22.41	99.9	1.028	97.5	-.5325	99	-21.22	99.9	.7350	99.5	-.8033	97.5	-19.85	99.9	1.256	95
E=Idle CO, %	5.0	6.0	.6000	80	6.434	95	.5562	70	.5675	97.5	9.175	99.9	.6162	95	.9137	95	6.594	95	.08125	<50
E=Idle Co, %	6.0	8.5	2.387	99.9	12.56	99.9	-.8375	75	2.000	99.9	12.78	99.9	-.6513	99	3.524	99.9	14.10	99.9	-.9300	75
AB=CD			-.2708	55	.3592	<50	.5663	75	-.2542	70	-1.153	50	.5303	97.5	-.2017	<50	-2.330	70	.1225	<50
AC=BD			-.6965	90	-7.114	99	.7550	90	-.3892	95	[illegible]	99.9	.3083	80	-.4700	75	-6.753	99	-.08917	<50
AD=BC			-.1475	<50	7.059	99	.7067	90	-2.750×10^{-2}	<50	-.700	99.5	.2933	75	.03333	<50	7.713	99.5	.8792	80
AE_1			.2100	<50	3.054	60	-.6488	75	.3275	70	[illegible]	70	-.6263	95	.1062	<50	2.176	55	-1.319	90
AE_2			.4725	70	2.464	50	.6375	70	.2925	65	3.302	90	.6437	95	.6137	75	3.276	75	.6175	60
BE_1			-.4675	70	-3.339	65	-.6013	70	-.06000	<50	-.577	97.5	-.6788	97.5	-.2617	<50	-3.711	75	-.08625	<50
BE_2			.3550	60	6.091	75	.5000	65	.1200	<50	4.947	97.5	.6337	75	.2057	<50	6.259	95	.4900	<50
CE_1			-.1425	<50	-6.388	<50	-.01125	<50	-.09000	<50	.7825	<50	-.08875	<50	-.04875	<50	-.6013	<50	.4688	<50
CE_2			.1350	<50	3.036	60	.3275	<50	.1725	<50	-.47	65	.1062	<50	.08125	<50	2.521	65	.3125	<50
DE_1			-.07000	<50	2.469	55	-.8788	90	.1725	<50	.535	55	-.2612	65	.00875	<50	2.221	60	-1.094	80
DE_2			-.4325	70	-1.694	50	.3450	<50	-.3450	75	-1.158	<50	.2612	60	-.6038	75	-.4063	<50	.2050	<50

			Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
	Increment		HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
Effect	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	-7.5	9.5	-60.69	<50	-2.047	99.9	1093	99.9	91.16	99.9	-.1617	70	709.3	99.9	329.7	99.9	-.09689	<50	-2.387	<50
B=Idle, rpm	440	600	76.20	60	.1089	70	-73.77	70	2.641	<50	.2015	80	-34.52	<50	-180.1	99.9	-.1916	80	6.731	60
C=PCV	Clsd.	Open	63.45	<50	-.7027	99.9	77.21	70	-25.00	97.5	-.7504	99.9	190.9	99.5	-26.96	<50	-.04370	<50	9.527	70
D=Air Cl, in H_2O	3.6	1.15	-102.2	70	-1.026	99.9	290.5	99.9	-21.10	95	-1.281	99.9	399.1	99.9	-31.91	55	-.1693	75	10.36	75
E=Idle CO, %	5.0	6.0	128.7	70	-.1355	70	3.868	<50	-8.175	<50	-.1663	75	28.91	<50	78.68	75	1.161	99.9	2.722	<50
E=Idle Co, %	6.0	8.5	-121.8	70	.2429	90	-122.7	75	56.63	99.9	.3394	90	-127.9	90	368.8	99.9	2.587	99.9	-11.30	70
AB=CD			-76.83	55	-.03319	<50	-5.262	<50	12.84	75	-.1266	65	52.79	60	-94.29	95	.08604	<50	4.712	<50
AC=BD			-98.53	65	.04726	<50	-17.86	<50	-7.787	60	-.1312	65	117.0	90	-5.126	<50	-.1296	65	-5.231	<50
AD=BC			94.52	65	.5013	99.9	-35.44	<50	7.299	55	.4495	99.5	-16.76	<50	-.5700	<50	.2321	90	-4.463	<50
AE_1			-144.1	75	.1513	75	-71.32	60	3.918	<50	.1782	70	-56.15	55	31.76	<50	.07181	<50	-10.82	70
AE_2			142.3	75	.09147	55	-70.51	60	13.16	70	.1047	<50	-53.57	50	127.9	97.5	.04834	<50	18.08	85
BE_1			120.1	65	-.08277	<50	26.62	<50	1.156	<50	.04619	<50	-98.70	75	-63.06	75	-1.316×10^{-3}	<50	-11.03	70
BE_2			-130.1	70	.03988	<50	-90.40	75	8.670	<50	.03544	<50	8.504	<50	-40.04	55	.2838	90	-6.262	<50
CE_1			130.9	70	.1214	65	-8.356	<50	3.911	<50	.2164	75	-44.15	<50	9.250	<50	.1680	65	3.010	<50
CE_2			-127.0	70	-.1216	65	33.40	<50	27.93	97.5	.1810	70	-63.56	60	38.66	55	1.178×10^{-2}	<50	-5.040	<50
DE_1			-143.2	75	.2069	75	-88.80	70	-12.07	65	.04074	<50	-78.45	70	-14.42	<50	.1020	<50	-.6423	<50
DE_2			136.1	70	-.06033	<50	-34.84	<50	-10.71	65	-.04064	<50	8.825	<50	-50.87	65	-.08011	<50	-.4185	<50

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 706
1961 Ford Falcon

Effect	Increment		1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
			HC		CO		NO$_x$		HC		CO		NO$_x$		HC		CO		NO$_x$	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	- 6	+11	.6117	97.5	-7.022	97.5	1.052	99.5	.3350	70	-4.700	95	.7475	99.9	.4058	75	-17.37	99.9	.7358	99.9
B=Idle, rpm	425	575	-.0600	<50	5.503	90	-.1308	<50	-.5033	95	7.703	99.5	-.0042	<50	-.0608	<50	5.778	97.5	-.0892	55
C=PCV	Clsd.	Open	.5767	95	-2.782	55	-.4142	75	-.0983	<50	-5.700	99	.0842	<50	.1675	<50	2.478	70	-.2892	99
D=Air Cl, in H_2O	1.10	0.65	-.6583	97.5	-13.43	99.9	.8292	99.5	-.1633	<50	-9.220	99.9	.6192	99.5	-.4642	80	-11.14	99.9	.4258	99.9
E=Idle CO, %	3.8	4.8	.2475	<50	-.4125	<50	.1350	<50	.1750	<50	.0288	<50	-.0013	<50	.2825	55	-3.585	75	.0825	<50
E=Idle Co, %	4.8	7.3	1.304	99.9	8.715	97.5	-.1450	<50	.8162	99	13.26	99.9	.1437	<50	1.569	99.9	8.577	99	-.0725	<50
AB=CD			.4633	90	6.895	95	-.1092	<50	.6083	97.5	5.650	99	-.0975	<50	.9875	99.5	4.227	90	-.2708	97.5
AC=BD			.1167	<50	2.767	55	-.5892	97.5	.0233	<50	2.177	70	-.3992	85	-.1708	<50	-3.017	75	-.1975	90
AD=BC			.2850	65	-2.115	<50	.2008	<50	.0983	<50	1.857	65	.3192	75	.1742	<50	1.148	<50	.0575	<50
AE$_1$			.0350	<50	2.612	<50	.1600	<50	.1075	<50	-2.316	65	.2387	55	-.0200	<50	2.782	65	.0400	<50
AE$_2$			.2287	<50	-1.950	<50	-.1775	<50	-.3837	70	-.3400	<50	-.1063	<50	.5338	80	-2.500	65	-.1950	75
BE$_1$			.1075	<50	2.777	<50	.1425	<50	-.2500	50	2.271	65	-.0663	<50	-.0350	<50	3.652	75	-.0050	<50
BE$_2$			-.1513	<50	-1.912	<50	.2800	50	-.0188	<50	.4200	<50	.1937	<50	-.3212	60	-3.955	80	.2250	90
CE$_1$			-.4000	70	.4650	<50	.0625	<50	-.3500	65	2.259	65	-.0663	<50	-.4000	70	2.932	70	-.0975	<50
CE$_2$			.6562	95	4.280	65	.1900	<50	.3012	60	.3425	<50	.1012	<50	.8487	97.5	3.237	70	-.0125	<50
DE$_1$			.1975	<50	3.640	55	.0600	<50	.2475	<50	-.7088	<50	.3037	70	-5.7×10^{-14}	<50	.8025	<50	.1275	60
DE$_2$			[illegible]	<50	-3.477	55	-.2375	<50	-.2488	<50	-3.338	80	.0063	<50	-.1263	<50	-3.948	80	-.0775	<50

Effect	Increment		Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
			HC		CO		NO$_x$		HC		CO		NO$_x$		HC		CO		NO$_x$	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	- 6	+11	106.5	99.9	-.5697	90	1246	99.9	99.57	99.9	-.4010	97.5	994.0	99.9	287.2	99.9	.0067	<50	2.960	50
B=Idle, rpm	425	575	9.672	<50	.1193	<50	108.6	<50	-8.747	<50	.3303	95	-130.0	65	-171.9	99.9	.1184	<50	-.3489	<50
C=PCV	Clsd.	Open	-25.35	90	.4101	75	-322.8	90	-52.51	90	-.5011	99.5	11.34	<50	-28.39	55	-.1664	60	1.359	<50
D=Air Cl, in H_2O	1.10	0.65	-35.25	97.5	-.3850	70	263.4	80	-23.29	<50	-.9925	99.9	565.6	99.9	-19.78	<50	-.0394	<50	7.431	95
E=Idle CO, %	3.8	4.8	9.109	<50	.0331	<50	-24.57	<50	17.86	<50	-.2940	75	118.5	50	54.84	75	.9236	99.9	-1.454	<50
E=Idle Co, %	4.8	7.3	13.69	<50	.6723	75	-141.9	<50	21.81	<50	.3767	90	-244.2	80	104.6	97.5	2.176	99.9	-13.82	99.5
AB=CD			40.52	97.5	.2195	<50	-109.7	<50	18.14	<50	.0675	<50	-101.5	55	-10.34	<50	-.0356	<50	1.975	<50
AC=BD			-5.894	<50	-.3945	70	120.3	<50	-26.60	55	.0156	<50	86.13	<50	-29.94	60	.1103	<50	1.390	<50
AD=BC			-20.59	55	-.0430	<50	66.21	<50	15.62	<50	.2362	75	.2944	<50	-11.09	<50	.3199	90	-9.618	99
AE$_1$			9.021	<50	.1050	<50	-91.48	<50	30.97	55	-.1276	<50	200.1	75	1.254	<50	-.4549	95	3.903	55
AE$_2$			-20.66	65	-.8676	[illegible]	372.2	90	-22.29	<50	.0374	<50	-206.0	75	31.07	50	.3532	80	-7.635	80
BE$_1$			-8.159	<50	.3461	60	-250.5	70	-23.62	<50	-.0842	<50	-50.99	<50	3.212	<50	-.0364	<50	-20.23	<50
BE$_2$			-24.71	75	-.5989	80	326.5	80	- .2880	<50	.0564	<50	-30.04	<50	-75.32	90	-.2262	65	1.527	<50
CE$_1$			9.056	<50	.2934	50	-183.3	60	-39.49	65	.3583	90	-267.0	90	-55.54	75	-.0951	<50	-2.626	<50
CE$_2$			-15.45	55	.6862	90	-309.5	80	21.78	<50	-.1188	<50	137.0	60	23.18	<50	.0134	<50	-2.819	<50
DE$_1$			8.335	<50	.1660	<50	-33.83	<50	39.00	65	.0979	<50	-16.86	<50	19.59	<50	.1007	<50	-5.262	65
DE$_2$			-20.85	65	-.0628	<50	103.5	<50	-55.22	75	-.0097	<50	-33.36	<50	15.34	<50	-.0580	<50	-1.631	<50

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 707
1963 Pontiac Bonneville

1972 Federal Hot Cycle

Effect	Increment -/0	Increment 0/+	HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO_x Level g/mi	NO_x Sign. %
A=Timing, deg	- 4	13	1.656	99.9	-23.17	95	2.918	99.9
B=Idle, rpm	500	600	-.7633	90	11.71	80	.5620	90
C=PCV	Clsd.	Open	-.3519	55	-11.99	80	-.4007	75
D=Air Cl, in H_2O	1.2	0.8	-.4034	60	-15.91	90	1.676	99.9
E=Idle CO, %	3.8	4.8	.6955	75	- .8989	<50	-1.135	99
E=Idle Co, %	4.8	7.3	1.649	99.5	15.61	75	.5252	75
AB=CD			.04521	<50	5.905	50	-.02305	<50
AC=BD			-.1995	<50	- 2.264	<50	-.09220	<50
AD=BC			$-2.660x10^{-3}$	<50	2.706	<50	.6436	95
AE_1			-.3126	<50	16.67	75	-.3324	60
AE_2			-.2606	<50	- 8.313	55	.3550	65
BE_1			-.6502	70	7.383	50	-.4734	75
BE_2			-.1915	<50	2.409	<50	.1343	<50
CE_1			-.1583	<50	- .9388	<50	-.1915	<50
CE_2			-.5505	65	3.522	<50	-.4215	70
DE_1			.05718	<50	1.713	<50	-.4920	75
DE_2			-.3005	<50	12.12	70	.3577	65

EPA Short Cycle

Effect	HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO_x Level g/mi	NO_x Sign. %
A=Timing, deg	2.228	99.9	-10.47	90	2.369	99.9
B=Idle, rpm	- .8183	95	7.887	70	.1277	<50
C=PCV	- .1303	<50	- 9.360	75	- .1135	<50
D=Air Cl, in H_2O	- .01507	<50	-10.96	90	.6667	99.5
E=Idle CO, %	.2301	<50	3.900	<50	- .5013	95
E=Idle Co, %	3.428	99.9	23.96	99.5	$2.660x10^{-3}$	<50
AB=CD	.09840	<50	4.588	<50	- .1082	<50
AC=BD	.08422	<50	.02926	<50	- .08688	<50
AD=BC	.08422	<50	- 1.597	<50	.2854	<50
AE_1	.6595	55	10.29	75	- .1157	<50
AE_2	2.078	75	- 4.368	<50	.1463	<50
BE_1	1.657	70	5.437	<50	.05452	<50
BE_2	.9133	60	1.937	<50	- .2447	55
CE_1	.2810	<50	8.623	65	- .06250	<50
CE_2	.1374	<50	5.193	<50	- .03723	<50
DE_1	$1.037x10^{-2}$	<50	- .8338	<50	- .1796	<50
DE_2	[illegible]$.809x10^{-3}$	50	5.031	<50	- .07713	<50

7-Mode Cycle

Effect	HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO_x Level g/mi	NO_x Sign. %
A=Timing, deg	1.894	99.9	-16.48	95	2.246	99.9
B=Idle, rpm	-1.697	99.9	3.869	<50	.2349	55
C=PCV	- .3476	65	- 9.318	70	-.06295	<50
D=Air Cl, in H_2O	- .1636	<50	-18.49	97.5	.8697	99.5
E=Idle CO, %	.6303	80	8.348	60	-.6170	90
E=Idle Co, %	4.502	99.9	19.09	95	.1489	<50
AB=CD	.05673	<50	8.235	65	-.2207	50
AC=BD	- .1082	<50	1.299	<50	.1587	<50
AD=BC	.1170	<50	4.281	<50	.2686	60
AE_1	-1.082	99.5	8.495	60	-.1543	<50
AE_2	.4654	70	- 1.602	<50	.1563	<50
BE_1	- .9149	97.5	8.309	55	-.02926	<50
BE_2	- .5798	75	6.054	<50	-.4787	75
CE_1	.5999	75	9.883	65	.09860	<50
CE_2	- .9388	97.5	3.916	<50	0.07181	<50
DE_1	.4309	65	2.229	<50	-.03723	<50
DE_2	- .3191	55	9.813	65	-.4441	70

Diagnostic 1 (49/45 MPH Cruise)

Effect	Increment -/0	Increment 0/+	HC Level ppm	HC Sign. %	CO Level % v	CO Sign. %	NO_x Level ppm	NO_x Sign. %
A=Timing, deg	- 4	13	52.63	99.9	-.1893	70	657.3	99.9
B=Idle, rpm	500	600	-9.666	55	-.04175	<50	76.84	60
C=PCV	Clsd.	Open	16.45	75	-.3225	95	109.2	75
D=Air Cl, in H_2O	1.2	0.8	-13.92	70	-.6277	99.9	421.7	99.9
E=Idle CO, %	3.8	4.8	15.80	65	.2397	70	-69.23	<50
E=Idle Co, %	4.8	7.3	9.283	<50	-.02891	<50	13.63	<50
AB=CD			-17.02	75	.1773	70	-106.2	70
AC=BD			1.020	<50	.02864	<50	-21.10	<50
AD=BC			-10.23	55	-.1577	65	108.0	70
AE_1			-14.91	65	.3300	90	-188.0	90
AE_2			16.21	70	-.2391	70	62.97	<50
BE_1			-11.55	55	-.1119	<50	42.30	<50
BE_2			- 2.944	<50	.2958	80	-153.1	80
CE_1			-11.83	55	.01358	<50	-8.805	<50
CE_2			23.77	75	-.01613	<50	-16.21	<50
DE_1			-8.369	<50	.08979	<50	-120.5	70
DE_2			-6.612	<50	-.1000	<50	32.39	<50

Diagnostic 2 (33/30 MPH Cruise)

Effect	HC Level ppm	HC Sign. %	CO Level % v	CO Sign. %	NO_x Level ppm	NO_x Sign. %
A=Timing, deg	97.17	99.9	-.3378	70	1160	99.9
B=Idle, rpm	-14.10	70	.2140	55	-85.75	<50
C=PCV	5.641	<50	-.5615	95	122.9	60
D=Air Cl, in H_2O	-9.483	55	-.3425	75	312.1	97.5
E=Idle CO, %	25.75	90	.08038	<50	-88.24	<50
E=Idle Co, %	17.92	75	-.03442	<50	125.7	55
AB=CD	-11.84	65	.1858	<50	-200.7	80
AC=BD	-8.265	<50	.1244	<50	56.22	<50
AD=BC	-12.35	65	-.2543	60	137.5	65
AE_1	-16.72	70	.4229	75	-138.9	60
AE_2	6.842	<50	-.4340	75	188.3	70
BE_1	-22.07	75	-.1046	<50	-3.138	<50
BE_2	-3.558	<50	.4224	75	-182.3	70
CE_1	-10.46	50	.2525	50	29.01	<50
CE_2	8.354	<50	-.10[illegible]	<50	83.43	<50
DE_1	-3.719	<50	-.05065	<50	-301.4	<50
DE_2	-9.729	<50	$-3.226x10^{-3}$	<50	-103.2	<50

Diagnostic 3 (Idle)

Effect	HC Level ppm	HC Sign. %	CO Level % v	CO Sign. %	NO_x Level ppm	NO_x Sign. %
A=Timing, deg	250.4	99.9	.3498	75	23.67	90
B=Idle, rpm	-143.9	99.9	-.1135	<50	28.43	95
C=PCV	21.73	75	-.4133	90	12.78	65
D=Air Cl, in H_2O	-40.25	90	-.3394	75	11.30	60
E=Idle CO, %	108.0	99.9	1.108	99.9	-29.32	90
E=Idle Co, %	164.7	99.9	2.093	99.9	-20.50	75
AB=CD	-70.48	99.9	-.3317	75	17.32	75
AC=BD	-4.836	<50	-.3391	75	13.13	65
AD=BC	-40.50	95	$-2.800x10^{-3}$	<50	11.02	55
AE_1	-4.508	<50	-.1827	<50	-7.702	<50
AE_2	28.68	75	-.1324	<50	-.8967	<50
BE_1	-86.73	99.9	-.2184	55	-7.810	<50
BE_2	-61.12	97.5	-.01174	<50	-15.23	65
CE_1	35.51	75	.5307	90	-27.16	75
CE_2	-61.0[illegible]	90	-.4337	75	8.465	<50
DE_1	-10.72	<50	.3782	80	-24.66	80
DE_2	-27.29	75	.08303	<50	13.04	55

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 708
1959 Oldsmobile 88

Effect	Increment		1972 Federal Hot Cycle						EPA Short Cycle						7-Mode Cycle					
			HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %	Level g/mi	Sign. %
A=Timing, deg	-5	12	1.431	70	-25.57	99.5	.5941	99.9	.2305	<50	-10.98	70	.2864	95	1.095	80	-19.79	99	.6622	97.5
B=Idle, rpm	370	510	-1.686	75	-6.673	65	-.02128	<50	-2.248	97.5	5.176	<50	.02039	<50	-1.929	99	3.493	50	.3236	80
C=PCV	Clsd.	Open	-.01950	<50	-15.29	95	.06205	<50	-.9486	55	-14.11	80	.1019	<50	-.6002	55	-11.65	75	.3360	80
D=Air Cl, in H_2O	15.4	0.65	-6.059	99.9	-74.06	99.9	.4362	99	-7.364	99.9	-80.50	99.9	.5700	99.9	-4.967	99.9	-59.35	99.9	.3613	75
E=Idle CO, %	3.8	4.8	.9202	<50	15.64	90	-.06782	<50	.5346	<50	11.39	65	-.2340	70	.8259	60	7.248	<50	-.7101	95
E=Idle Co, %	4.8	7.3	.4109	<50	8.247	65	-.04122	<50	1.528	65	8.690	50	-.04920	<50	2.180	97.5	18.33	95	-.01995	<50
AB=CD			-1.154	65	-.8883	<50	.06737	<50	.3546	<50	-1.923	<50	.04167	<50	.02748	<50	.1720	<50	-.2261	65
AC=BD			.9450	55	9.553	75	-.1152	<50	1.864	95	5.572	<50	-.08954	<50	1.061	80	7.931	65	-.3519	75
AD=BC			-1.087	55	8.039	70	.2093	75	-.6259	<50	-8.268	60	.1551	65	-1.381	95	1.101	<50	.3555	75
AE_1			.9761	<50	11.23	75	.1741	60	1.550	65	8.183	<50	-.1809	60	1.185	75	11.76	70	.2793	65
AE_2			-1.341	60	-20.05	95	-.04388	<50	-1.802	75	-23.47	95	.1210	<50	-.3684	<50	-12.13	70	.1156	<50
BE_1			-.1330	<50	-.6410	<50	-.4135	95	.07181	<50	1.968	<50	-.1569	55	-.1369	<50	3.394	<50	-.7394	95
BE_2			.1901	<50	-5.170	<50	.2965	80	-.08910	<50	8.586	<50	-.1104	<50	-.2808	<50	.7300	<50	.2007	50
CE_1			.3963	<50	-2.303	<50	-.4694	97.5	.6622	<50	6.420	<50	-.09043	<50	-.3232	<50	3.989	<50	-.7766	97.5
CE_2			.3763	<50	6.755	<50	.2699	75	-.03856	<50	-1.315	<50	.1024	<50	-.2221	<50	-7.377	<50	.2300	60
DE_1			-.8271	<50	-3.803	<50	.08112	<50	2.660×10^{-3}	<50	-1.141	<50	-.07713	<50	-.2301	<50	1.952	<50	.3378	75
DE_2			1.451	65	16.38	90	-.1343	<50	.05186	<50	13.30	70	-.01197	<50	.4615	<50	5.297	<50	.07580	<50

Effect	Increment		Diagnostic 1 (49/45 MPH Cruise)						Diagnostic 2 (33/30 MPH Cruise)						Diagnostic 3 (Idle)					
			HC		CO		NO_x		HC		CO		NO_x		HC		CO		NO_x	
	-/0	0/+	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %	Level ppm	Sign. %	Level % v	Sign. %	Level ppm	Sign. %
A=Timing, deg	-5	12	49.43	99.9	2.212×10^{-3}	<50	739.6	99.9	69.57	99.5	.4578	55	179.8	99	345.8	99	6.094×10^{-2}	<50	2.786	55
B=Idle, rpm	370	510	-23.82	95	.2438	99.9	-33.33	55	-28.23	75	.09953	<50	26.96	<50	-522.6	99.9	-.2179	65	14.35	99.9
C=PCV	Clsd.	Open	-22.52	95	-.4615	99.9	105.3	99.9	-31.40	75	-.8915	90	127.0	95	-52.10	<50	-6.078×10^{-3}	<50	-1.607	<50
D=Air Cl, in H_2O	15.4	0.65	-16.70	90	-.3797	99.9	102.8	97.5	-59.08	97.5	-1.759	99.9	252.8	99.9	22.40	<50	9.763×10^{-2}	<50	-.4053	<50
E=Idle CO, %	3.8	4.8	23.84	90	.1572	97.5	-59.79	70	30.49	70	.3765	<50	-46.71	<50	137.1	55	.8380	99.5	-6.701	90
E=Idle Co, %	4.8	7.3	2.660	<50	.03264	<50	-20.28	<50	-15.92	<50	-.7434	65	102.6	75	212.6	75	1.974	99.9	-9.834	97.5
AB=CD			-1.511	<50	.03033	<50	-28.75	<50	2.733	<50	-.01142	<50	-12.48	<50	-213.3	90	.3541	80	-1.002	<50
AC=BD			3.243	<50	-.08735	75	111.4	99	6.531	<50	-.07570	<50	98.38	80	.1463	<50	-.1085	<50	-3.680	65
AD=BC			-3.291	<50	.1001	90	-54.95	75	-33.87	80	-.6672	70	94.13	80	58.76	<50	-.03069	<50	.4079	<50
AE_1			15.33	75	-2.444×10^{-3}	<50	4.399	<50	40.04	80	.6926	65	-33.14	<50	30.41	<50	-.1727	<50	15.64	99.9
AE_2			-18.66	80	.03199	70	-34.71	<50	-51.68	90	-.8136	70	98.86	70	2.758	<50	-.01339	<50	-5.070	70
BE_1			-21.34	90	.1650	97.5	-49.89	65	-22.96	55	.4248	<50	-2.687	<50	-45.15	<50	.2899	65	-3.983	65
BE_2			8.364	<50	-.1096	80	62.01	75	21.89	55	-.08713	<50	-44.61	<50	-135.7	55	.03048	<50	-10.14	97.5
CE_1			-11.90	65	.02409	<50	-79.57	75	-6.219	<50	.3381	<50	-39.21	<50	101.7	<50	.09771	<50	-2.419	<50
CE_2			-.7138	<50	-.06113	55	21.56	<50	-15.97	<50	-.6567	65	85.07	65	-222.5	75	-.2713	65	-3.365	55
DE_1			2.452	<50	-.08859	70	-19.34	<50	-2.948	<50	-.05480	<50	-1.469	<50	-65.00	<50	.08277	<50	-5.566	75
DE_2			-19.10	75	.03314	<50	1.593	<50	-2.782	<50	.4491	<50	-72.81	60	121.5	<50	-.09443	<50	3.336	55

TABLE 2

SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 801
1971 Dodge Charger

Effect	Increment -/0	Increment 0/+	1972 FEDERAL HOT CYCLE HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
A = Timing, deg.	-10.0	+7.0	0.5830	99.9	-22.17	99.9	2.815	99.9
B = Idle, rpm	560	770	-2.750x10^{-2}	<50	2.331	<50	2.875x10^{-2}	<50
C = PCV	Open	Closed	0.2600	96.0	31.00	99.7	-0.3688	99.9
D = Air Cl. in H$_2$O	Open	Fail	0.3502	93.0	16.94	99.9	-0.3190	99.8
E = Idle CO, %	0.5	1.5	0.4350	95.8	17.81	99.9	0.1475	<50
F = NO$_x$ Control	Op.	Fail	0.2347	<50	9.763	97.0	0.4325	98.4
AB			0.1961	95.0	[illegible]	<50	7.000x10^{-2}	<50
AC			5.125x10^{-2}	<50	3.313	<50	9.000x10^{-2}	<50
AD			1.000x10^{-2}	22	1.344	44.0	0.1625	<50
AE			1.750x10^{-2}	22	2.516	44.0	0.3145	20.0
AF			2.650	20.0	2.766	38.0	0.1313	23.0
BC			3.42 x10^{-2}	<50	2.336	<50	0.1463	75.0
BD			2.100x10^{-2}	<50	0.9944	<50	0.1475	[illegible]
BE			0.1113	<50	2.125	<50	0.2375	<50
BF			4.025x10^{-2}	<50	1.922	<50	0.2250	32.0
CD			8.750x10^{-2}	<50	5.000	90.0	0.1200	<50
CE			0.2375x10^{-2}	<50	-7.882	92.0	1.500x10^{-2}	<50
CF			0.1150	<50	8.298	96.0	2.000x10^{-2}	<50
DE			3.000x10^{-2}	<50	-3.633	54.0	4.875x10^{-2}	<50
DF			-0.1263	<50	3.437	<50	0.1413	21.0
EF			1.000x10^{-2}	<50	4.114	90.0	0.5738	99.0
Total Sums of Squares			11.39		1.668x10^{4}		96.65	
Mean Square Residual			0.1281		101.3		0.3393	
Degrees of Freedom			26		[illegible]		23	
Mean Square-Stability Tests			0.1112		136.1		0.7434	
F Statistic			1.12		<1.0		<1.0	
Confidence of Difference, %			50		<50		<50	

EPA SHORT CYCLE HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
0.8212	99.9	-23.77	99.9	1.414	99.2
-0.2475	99.9	3.048	68.0	0.1250	92.0
0.2287	98.7	4.004	98.0	-5.000x10^{-2}	<50
-2.375x10^{-2}	<50	7.866	99.8	-0.2375	92.0
0.3962	99.6	22.37	99.9	-0.2900	98.2
3.2 x10^{-2}	<50	-4.792	93.0	0.2062	91.0
0.1712	34.0	0.3436	<50	0.2213	71.0
[illegible]	<50	[illegible]	<50	[illegible]	<50
[illegible]	<50	[illegible]	<50	[illegible]	<50
[illegible]	<50	[illegible]	<50	[illegible]	<50
0.4562	[illegible]	[illegible]	92.2	[illegible]	<50
[illegible]	<50	[illegible]	<50	[illegible]	92.2
[illegible]	<50	[illegible]	<50	[illegible]	99.0
0.2987	99.5	[illegible]	99.8	[illegible]	99.2
9.750x10^{-2}	<50	[illegible]	92.0	[illegible]	<50
2.250x10^{-2}	<50	3.461	75.0	-0.1825	88.0
[illegible]	<50	-0.9781	<50	0.2225	92.0
[illegible]	22	2.367	<50	0.1483	75.0
0.1100	54	-3.193	<50	4.750x10^{-2}	<50
-0.1688	24.0	-0.8244	<50	-0.3125	99.0
0.1137	61	1.657	94.0	1.875x10^{-2}	<50
10.28		8593		24.23	
6.694x10^{-2}		17.92		9.306x10^{-2}	
26		22		22	
1.604x10^{-2}		15.56		4.367x10^{-2}	
<1.0		<1.07		2.13	
<50		<50		60	

7-MODE CYCLE HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
1.063	99.9	-26.42	99.9	2.452	99.9
-0.8869	99.9	5.809	99.6	0.2475	75.0
0.1319	70.0	3.677	94.0	-0.3388	75.0
6.362x10^{-2}	<50	9.737	99.9	-0.1925	<50
0.2369	72.0	21.38	99.9	-0.4388	92.0
0.1131	67.0	-8.165	99.9	0.9350	99.9
6.938x10^{-2}	<50	-2.400	<50	[illegible]	97.5
9.38x10^{-2}	<50	[illegible]	90.0	[illegible]	<50
3.188x10^{-2}	<50	[illegible]	<50	[illegible]	<50
-0.1294	32.0	[illegible]	92.0	[illegible]	<50
0.2269	87.0	[illegible]	93.2	[illegible]	27.5
-1.187x10^{-2}	<50	4.857	98.0	-0.9075	98.5
-6.312x10^{-2}	<50	[illegible]	<50	[illegible]	<50
0.2656	99.0	[illegible]	99.5	[illegible]	<50
-1.312x10^{-2}	<50	[illegible]	<50	[illegible]	62.0
2.562x10^{-2}	<50	-0.3584	<50	-0.2475	<50
9.375x10^{-3}	<50	[illegible]	89.5	[illegible]	97.0
0.1356	78.0	-4.000	96.0	[illegible]	<50
9.812x10^{-2}	33	-1.971	<50	-0.2475	<50
-9.812x10^{-2}	33	-0.2412	<50	-0.1213	<50
3.362x10^{-2}	<50	1.253	<50	-4.250x10^{-2}	<50
18.9		1.281x10^{4}		77.61	
5.112x10^{-2}		24.91		0.4431	
26		18		24	
2.238x10^{-1}		23.03		0.1572	
<1.0		1.08		2.82	
<50		<50		80	

Effect	Increment -/0	Increment 0/+	DIAGNOSTIC 1 (49/45 MPH CRUISE) HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
A = Timing, deg.	-10.0	+7.0	78.13	99.9	776	94.0	1127	99.9
B = Idle, rpm	560	770	-4.604	66.0	[illegible]x10^{-2}	<50	14.02	<50
C = PCV	Open	Closed	5.923	78.0	630	99.9	-250.2	99.9
D = Air Cl. in H$_2$O	Open	Fail	15.26	99.9	0.8881	99.9	-466	99.9
E = Idle CO, %	0.5	1.5	2.105	<50	0.1094	93.0	91.61	95.0
F = NO$_x$ Control	Op.	Fail	5.268	72.0	-0.1244	66.0	16.27	<50
AB			-1.339	<50	-2.69 x10^{-2}	<50	36.41	56.0
AC			4.075	38	4.837x10^{-2}	<50	42.19	<50
AD			-3.432	91.0	0.1152	62.0	-64.96	85.0
AE			0.7218	<50	2.649x10^{-2}	<50	42.17	<50
AF			-4.366	75.0	2.523x10^{-2}	<50	-7.146	<50
BC			1.341	<50	4.123x10^{-2}	<50	-19.94	<50
BD			5.36x10^{-1}	[illegible]	[illegible]	<50	29.03	93.0
BE			[illegible]	[illegible]	[illegible]	<50	[illegible]	<50
BF			-7.07	92.0	[illegible]	<50	[illegible]	<50
CD			-1.348	<50	-0.1125	66.0	99.34	93.0
CE			[illegible]	<50	[illegible]	<50	[illegible]	<50
CF			[illegible]	<50	-0.1682	92.0	73.80	85.0
DE			-3.818	25.0	5.498x10^{-2}	<50	2.233	<50
DF			[illegible]	<50	[illegible]	55.0	[illegible]	20.0
EF			1.905	<50	5.630x10^{-2}	<50	16.18	<50
Total Sums of Squares			1.679x10^{4}		10.41		1.318x10^{7}	
Mean Square Residual			108.4		7.81x10^{-2}		1.033x10^{5}	
Degrees of Freedom			26		22		23	
Mean Square-Stability Tests			181.3		9.463x10^{-1}		3.318x10^{5}	
F Statistic			4.0		6.28		[illegible]	
Confidence of Difference, %			<50		80		<50	

DIAGNOSTIC 2 (35/30 MPH CRUISE) HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
76.48	99.9	-2.890x10^{-2}	<50	1162	99.9
-0.7534	<50	7.104x10^{-2}	<50	-115.7	92.0
32.66	99.9	0.5969	99.9	-186.1	99.0
26.22	99.9	0.4108	99.9	-107.8	90.0
9.227	95.0	5.059x10^{-2}	<50	-74.78	62.0
-5.757	64.0	-0.2576	99.2	33.68	<50
-4.792	54	1.036x10^{-2}	<50	-122.6	91.0
2.535	<50	3.351x10^{-2}	<50	-93.35	75.0
2.705	<50	2.656x10^{-2}	<50	-126.1	94.0
-0.7242	<50	-0.1446	92.0	32.45	<50
-2.1359	<50	5.885x10^{-2}	<50	64.66	<50
2.306	<50	4.234x10^{-2}	<50	64.67	54
3.763	<50	-3.357x10^{-2}	<50	-34.66	<50
7.433	88.0	9.36x10^{-2}	52	-16.97	<50
-8.720	75.0	-7.87x10^{-2}	60.0	-28.44	<50
1.931	<50	0.1363	99.9	-198.8	99.5
5.475	75.0	9.637x10^{-2}	75.0	123.1	89.0
1.881	<50	-0.1034	73.0	47.68	89.0
-9.653	75.0	-0.1329	93.0	5.012	<50
2.191	38	3.066x10^{-2}	<50	-5.890	<50
-8.130	50	4.961x10^{-2}	<50	3.76	<50
6.396x10^{4}		7.188		1.221x10^{7}	
236.1		4.781x10^{-2}		2.933x10^{4}	
26		22		[illegible]	
573.3		3.127x10^{-2}		1.018x10^{4}	
2.43		4.68		2.88	
<50		80		80	

DIAGNOSTIC 3 (IDLE) HC Level g/mi	HC Sign. %	CO Level g/mi	CO Sign. %	NO$_x$ Level g/mi	NO$_x$ Sign. %
91.28	99.9	5.054x10^{-3}	<50	-27.35	98.0
-40.66	99.9	-5.317x10^{-2}	<50	29.60	99.0
6.303	97.0	1.624x10^{-3}	<50	-2.873	<50
0.7082	<50	-8.866x10^{-2}	75.0	-4.572x10^{-2}	<50
60.78	99.9	0.3229	99.9	-50.14	99.9
9.485	99.8	0.1465	98.0	-1.224	<50
-15.33	99.9	6.182x10^{-2}	96.0	-13.99	84.0
7.129	98.5	8.106x10^{-2}	75.0	-10.31	<50
4.582	90.0	0.1527	98.0	-15.18	68.0
20.05	99.9	-7.610x10^{-2}	75.0	14.02	84.0
3.628	75.0	-3.097x10^{-2}	<50	16.74	74.0
-1.059	<50	-0.2195	94.0	-5.294	<50
-0.7335	<50	-1.332x10^{-3}	<50	4.151	<50
-1.448	<50	0.1278	96.0	-9.692	<50
-0.8056	<50	8.340x10^{-2}	75.0	-6.905	<50
1.254	<50	0.1163	93.0	-1.744	<50
1.256	<50	-2.218x10^{-2}	<50	9.305	<50
4.063	75.0	-4.726x10^{-2}	<50	2.343	<50
3.307	75.0	-4.259x10^{-2}	<50	8.362	<50
-0.3591	<50	-9.802x10^{-2}	88.0	-8.222	<50
0.2186	<50	-9.188x10^{-3}	<50	4.850	<50
1.400x10^{5}		84.86		1.802x10^{4}	
54.21		2.697x10^{-2}		889.9	
22		24		28	
86.49		4.222x10^{-2}		90.70	
<1.0		<1.0		9.8	
<50		<50		95	

TABLE 2
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 802
1971 Chevrolet Nova

EFFECT	INCREMENT		1972 FEDERAL HOT CYCLE					
			HC		CO		NO_x	
	-	+	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	Open	Closed	0.3195	99.9	10.11	99.9	0.1516	<50
B = AE = Timing, degrees	-4	+13	1.1415	99	-9.586	99.9	3.600	99.9
C = DE = Idle rpm	600	440	0.06258	55	7.973	99.9	-0.5789	65
D = CE = Air Cleaner, in. H_2O	1.15	11.30	0.3604	99.9	1.931	65	0.3086	<50
E = AB = CD = NO_x	Up	Failed	0.6914	99.9	-1.135	<50	0.2508	<50
F1(-1 to 0) = Idle CO, % v	0.5	1.5	0.2194	97.5	6.532	99.5	-0.9401	75
F2(0 to +1) = Idle CO, % v	1.5	3.5	0.2433	99	19.36	99.9	-1.111	50
AC = BD			0.3351	99.9	-1.607	65	0.3519	<50
AD = BC			0.2944	99.9	1.319	<50	-0.8038	80
AF_1			0.06775	<50	2.634	65	-0.5226	<50
AF_2			-0.2461	99	2.868	70	0.1236	<50
BF_1			-0.05186	<50	0.4324	<50	-1.297	95
BF_2			-0.2539	99	-1.266	<50	0.3337	<50
CF_1			0.03058	<50	-1.820	<50	0.7380	65
CF_2			-0.05886	<50	-3.765	90	0.1449	<50
DF_1			-9.396×10^{-3}	<50	-1.606	50	0.2991	<50
DF_2			6.649×10^{-3}	<50	3.698	90	-0.4502	<50
EF_1			0.02526	<50	-0.02080	<50	-0.4376	<50
EF_2			-0.1689	95	0.4561	<50	0.1450	<50
Total Sums of Squares			16.09		4889		123.3	
Mean Square Residual			2.012×10^{-2}		14.70		1.636	
Degrees of Freedom			11		14		20	
Mean Square-Stability Tests			1.369×10^{-1}		1.008×10^{-3}		1.620	
F Statistic			<1.0		1350		<1.0	
Confidence of Difference, %			<50		>99.9		<50	

EFFECT	EPA SHORT CYCLE					
	HC		CO		NO_x	
	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	0.4580	99.9	8.345	99.9	-0.2757	<50
B = AE = Timing, degrees	1.038	99.9	-3.653	99	1.600	99.9
C = DE = Idle rpm	-0.1162	65	-8.361	99.9	-0.3253	55
D = CE = Air Cleaner, in. H_2O	0.3386	99.5	4.704	99.5	0.08954	<50
E = AB = CD = NO_x	0.5206	99.9	[illegible]	97.5	0.3167	50
F1(-1 to 0) = Idle CO, % v	1.024	55	6.635	99.9	-0.3417	50
F2(0 to +1) = Idle CO, % v	0.3444	97.5	18.80	99.9	-0.5274	95
AC = BD	0.1960	90	-0.5204	<50	0.1764	<50
AD = BC	0.2367	95	1.0345	80	-0.06827	<50
AF_1	-0.09813	55	1.172	60	-0.1689	<50
AF_2	-0.1982	75	5.470	99.5	-0.06383	<50
BF_1	-0.07324	<50	1.973	75	-0.5173	65
BF_2	-0.1476	70	-0.02394	50	7.978×10^{-3}	<50
CF_1	0.01197	<50	0.9534	97.5	-0.2487	90
CF_2	-0.1036	55	-7.078	99.9	0.3637	50
DF_1	-0.06654	50	-1.189	60	0.5305	65
DF_2	0.1635	70	4.714	99	-0.1888	<50
EF_1	-0.07739	50	1.176	80	0.02792	<50
EF_2	-0.2354	90	-2.351	75	-0.7606	75
Total Sums of Squares	12.96		4551		40.13	
Mean Square Residual	6.361×10^{-2}		7.702		0.6490	
Degrees of Freedom	11		10		18	
Mean Square-Stability Tests	5.800×10^{-2}		0.0100		1.434	
F Statistic	1.10		770		<1.0	
Confidence of Difference, %	50		99.9		<50	

EFFECT	7-MODE CYCLE					
	HC		CO		NO_x	
	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	0.6108	99.9	5.816	99.9	0.1669	<50
B = AE = Timing, degrees	1.201	99.9	-8.064	99.9	2.366	99.9
C = DE = Idle rpm	0.07713	50	-7.353	99.9	-0.1702	<50
D = CE = Air Cleaner, in. H_2O	0.4370	99.5	4.308	99.9	0.1631	<50
E = AB = CD = NO_x	0.7083	99.9	0.7731	65	0.4736	75
F1(-1 to 0) = Idle CO, % v	9.308×10^{-3}	50	7.951	99.9	-0.4441	60
F2(0 to +1) = Idle CO, % v	0.2807	80	8.933	99.9	-0.4013	90
AC = BD	0.2068	90	-2.784	99	0.1196	<50
AD = BC	0.4370	99.5	1.761	80	-0.1489	<50
AF_1	-0.1298	65	0.3763	50	-0.1676	<50
AF_2	-0.3019	90	1.137	75	-7.588×10^{-15}	<50
BF_1	-0.2634	90	-0.3551	<50	-0.5638	65
BF_2	-0.2268	75	-1.171	75	0.2048	<50
CF_1	-0.2487	80	-2.650	97.5	0.9867	97.5
CF_2	-0.06222	<50	-3.458	99	0.1649	<50
DF_1	-0.1556	70	-0.3976	50	0.3670	50
DF_2	0.1369	65	4.956	99.5	-0.08245	<50
EF_1	-0.1636	75	1.165	75	0.1915	<50
EF_2	-0.2062	75	3.414	99	-0.8298	95
Total Sums of Squares	19.58		4366		57.10	
Mean Square Residual	7.202×10^{-2}		3.811		0.6121	
Degrees of Freedom	9		9		18	
Mean Square-Stability Tests	5.700×10^{-3}		3.000×10^{-4}		5.090	
F Statistic	<1.0		12700		<1.0	
Confidence of Difference, %	<50		>99.9		<50	

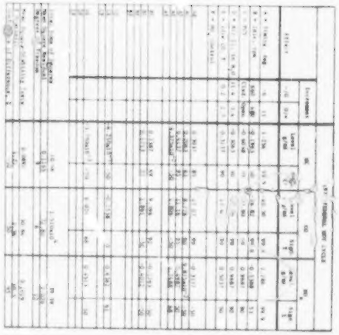
EFFECT	INCREMENT		DIAGNOSTIC 1 (49/45 MPH CRUISE)					
			HC		CO		NO_x	
	-	+	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	Open	Closed	25.91	99.9	0.08270	95	379.9	97.5
B = AE = Timing, degrees	-4	+13	59.99	99.9	-0.03392	50	1660	99.9
C = DE = Idle rpm	600	440	5.494	75	0.03174	50	8.409	<50
D = CE = Air Cleaner, in. H_2O	1.15	11.30	8.225	90	0.01582	<50	97.50	50
E = AB = CD = NO_x	Up	Failed	-0.2468	<50	0.01198	<50	-173.3	70
F1(-1 to 0) = Idle CO, % v	0.5	1.5	-5.661	65	-0.01777	<50	21.59	<50
F2(0 to +1) = Idle CO, % v	1.5	3.5	-9.586	90	0.02459	<50	-357.9	90
AC = BD			8.677	95	0.01855	<50	176.5	70
AD = BC			-1.649	<50	-0.03166	50	70.54	<50
AF_1			5.439	65	2.788×10^{-3}	<50	-103.0	<50
AF_2			-14.29	97.5	-0.06358	65	-196.3	65
BF_1			-7.791	75	-0.06380	65	-123.5	50
BF_2			0.4494	<50	0.03410	50	-72.31	<50
CF_1			7.462	75	0. 5872	60	6.674	<50
CF_2			3.789	60	-0.0116	<50	290.4	85
DF_1			-7.052	75	-0.05429	55	-10.47	<50
DF_2			12.79	97.5	0.05619	60	199.4	70
EF_1			-1.263	<50	-0.03210	50	53.55	<50
EF_2			4.700	60	0.08681	75	-233.9	75
Total Sums of Squares			3.041×10^{4}		0.2294		2.039×10^{7}	
Mean Square Residual			88.20		8.562×10^{-3}		241×10^{3}	
Degrees of Freedom			11		22		19	
Mean Square-Stability Tests			25.31		1.700×10^{-4}		1.516×10^{4}	
F Statistic			3.48		50.4		<1.0	
Confidence of Difference, %			80		99.5		<50	

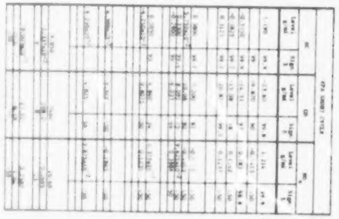
EFFECT	DIAGNOSTIC 2 (33/30 MPH CRUISE)					
	HC		CO		NO_x	
	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	28.01	99	0.1517	75	16.96	<50
B = AE = Timing, degrees	67.64	99.9	-0.07393	55	1191	99.9
C = DE = Idle rpm	-9.285	50	-0.1102	70	-144.3	65
D = CE = Air Cleaner, in. H_2O	8.548	50	0.1013	65	-51.55	<50
E = AB = CD = NO_x	-7.738	<50	-0.05371	<50	-321.5	85
F1(-1 to 0) = Idle CO, % v	0.9339	<50	0.02116	<50	33.18	<50
F2(0 to +1) = Idle CO, % v	7.668	<50	0.2426	95	269.6	85
AC = BD	17.36	75	-0.04561	[illegible]	204.2	75
AD = BC	1.695	<50	0.1202	70	117.6	60
AF_1	6.238	<50	0.01160	<50	-119.2	80
AF_2	-8.933	50	0.1510	70	-166.6	85
BF_1	0.7016	<50	0.01983	<50	-113.0	80
BF_2	-6.911	<50	-0.09817	55	-123.7	85
CF_1	2.885	<50	-5.138×10^{-3}	<50	11.93	<50
CF_2	-5.05[illegible]	50	-0.1463	70	239.7	85
DF_1	-9.888	50	-0.02381	<50	95.39	<50
DF_2	26.26	95	0.1987	90	-0.7687	<50
EF_1	1.508	<50	6.667×10^{-3}		-41.75	<50
EF_2	0.8186	<50	-0.09331	55	-257.8	85
Total Sums of Squares	4.257×10^{4}		1.504		1.160×10^{7}	
Mean Square Residual	495.9		5.115×10^{-2}		1.140×10^{5}	
Degrees of Freedom	21		20		20	
Mean Square-Stability Tests	27.86		1.700×10^{-4}		1.502×10^{4}	
F Statistic	17.8		<1.0		<1.0	
Confidence of Difference, %	97.5		<50		<50	

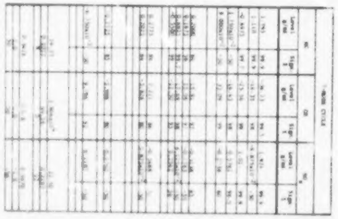
EFFECT	DIAGNOSTIC 3 (IDLE)					
	HC		CO		NO_x	
	Level g/mile	Sign. %	Level g/mile	Sign. %	Level g/mile	Sign. %
A = BE = PCV	102.6	90	0.2214	90	83.17	95
B = AE = Timing, degrees	202.1	99.5	0.2233	90	108.2	97.5
C = DE = Idle rpm	133.1	97.5	0.08590	50	-284.0	99.9
D = CE = Air Cleaner, in. H_2O	124.1	95	0.2140	90	-117.5	99
E = AB = CD = NO_x	178.8	99.5	0.1226	65	180.8	99.9
F1(-1 to 0) = Idle CO, % v	-46.06	50	1.034	99.9	-149.0	99
F2(0 to +1) = Idle CO, % v	26.31	<50	1.800	99.9	-154.9	99
AC = BD	107.[illegible]	95	0.1251	65	16.97	<50
AD = BC	99.13	90	8.016×10^{-3}	50	-55.51	90
AF_1	-42.22	<50	-0.1373	60	-66.96	85
AF_2	-74.18	65	0.2569	90	-35.37	60
BF_1	-35.09	<50	0.2428	85	-85.05	90
BF_2	-62.75	60	-0.02054	<50	-35.67	60
CF_1	-47.88	50	0.1426	60	80.35	90
CF_2	-16.81	<50	0.09157	<50	137.6	99
DF_1	-36.92	<50	0.07695	50	27.45	55
DF_2	-37.48	<50	0.4238	97.5	59.88	85
EF_1	-72.63	65	0.1077	55	-76.31	90
EF_2	20.88	<50	-0.06546	<50	-49.98	90
Total Sums of Squares	1.095×10^{7}		36.25		1.716×10^{6}	
Mean Square Residual	1.536×10^{4}		8.596×10^{-2}		4581	
Degrees of Freedom	16		16		5	
Mean Square-Stability Tests	36.72		2.600×10^{-2}		616.5	
F Statistic	418		3.30		7.43	
Confidence of Difference, %	99.9		80		90	

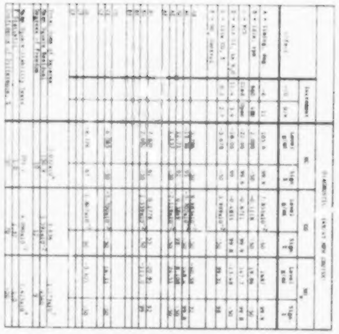
TABLE 2

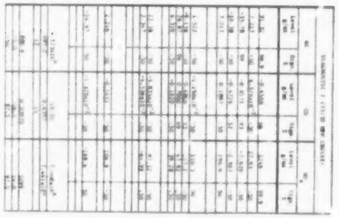
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 803
1971 Mercury Colony Park Station Wagon

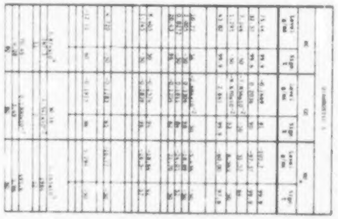












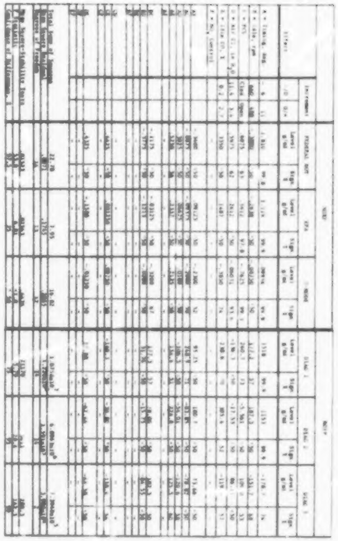
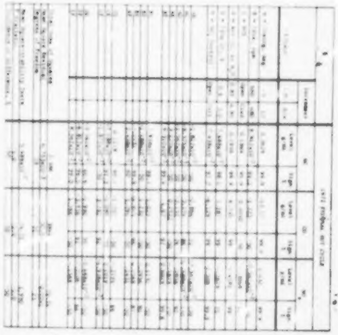
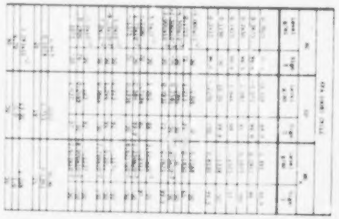
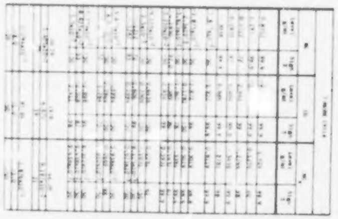


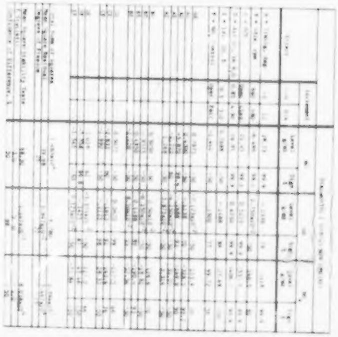
TABLE 2

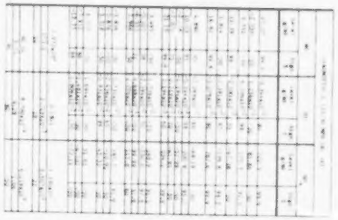
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 804
1971 Rambler Hornet

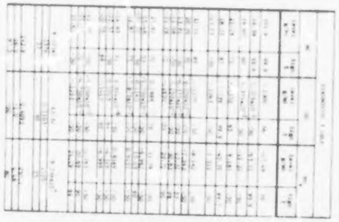












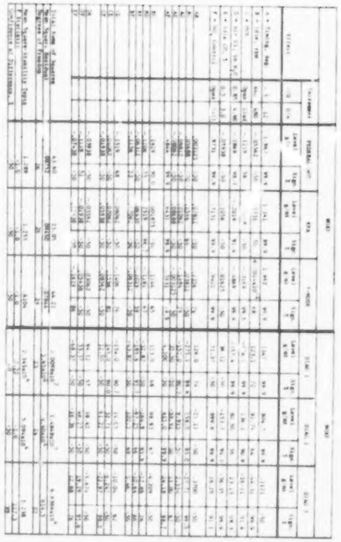
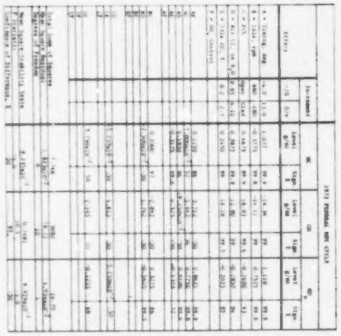
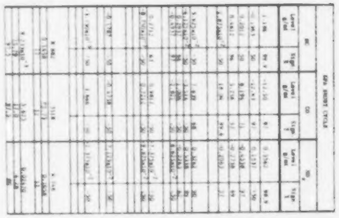
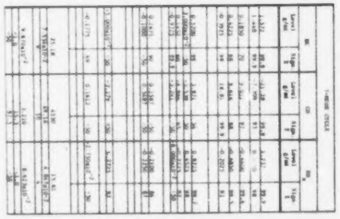


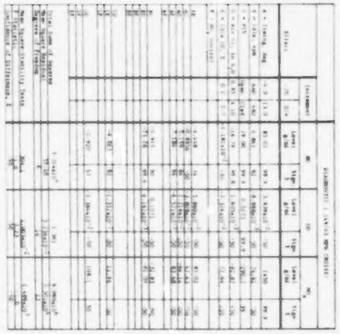
TABLE 2

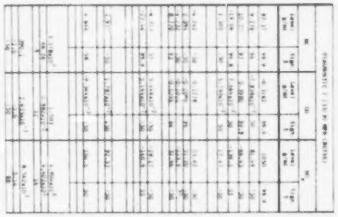
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 805
1971 Ford Galaxie

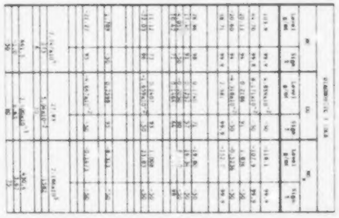












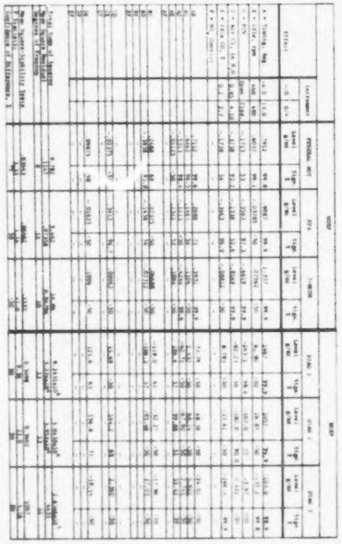
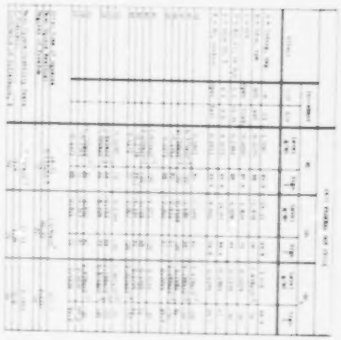
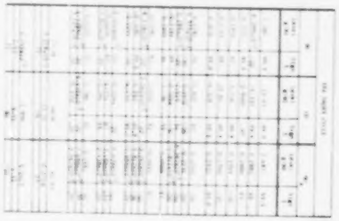
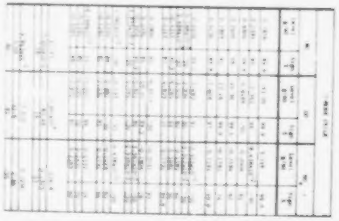


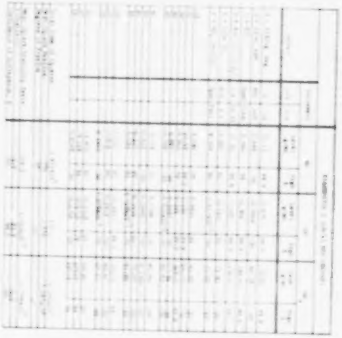
TABLE 2

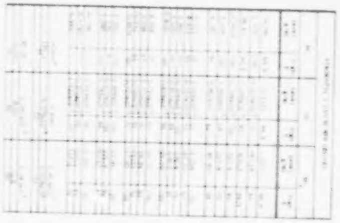
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 806
1971 Chevrolet Malibu

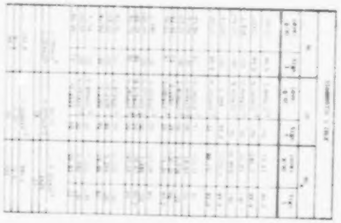












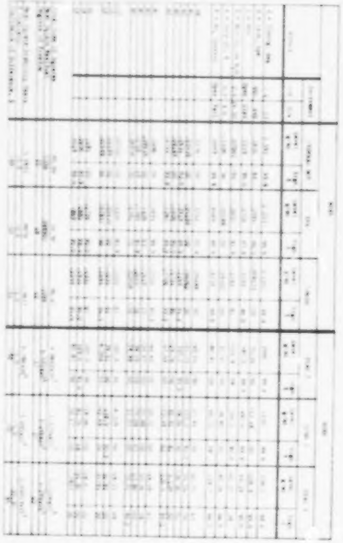
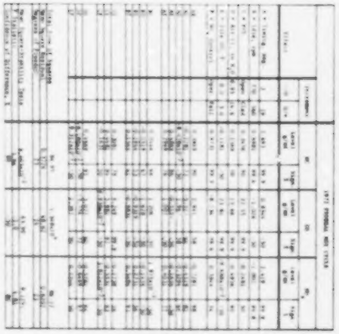
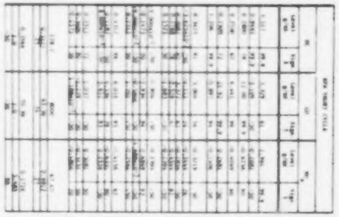
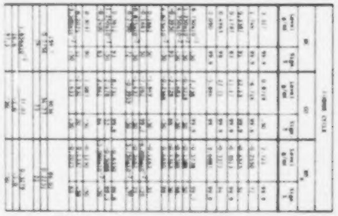


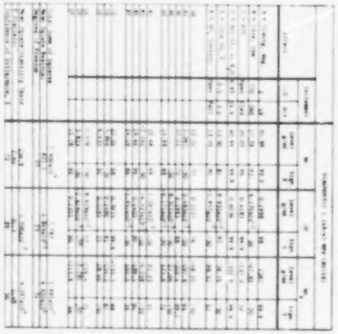
TABLE 2

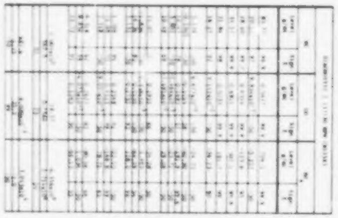
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 807
1971 Pontiac Grand Prix

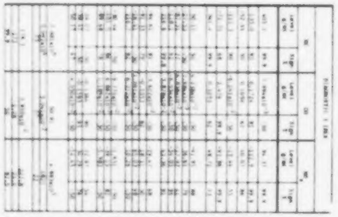












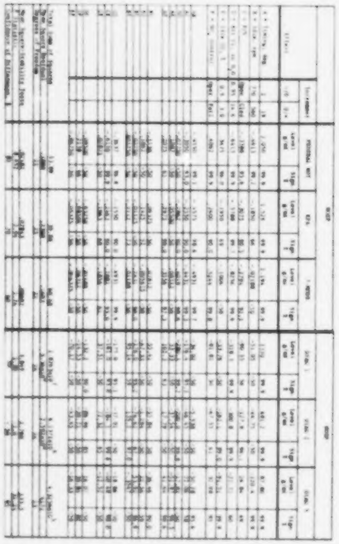
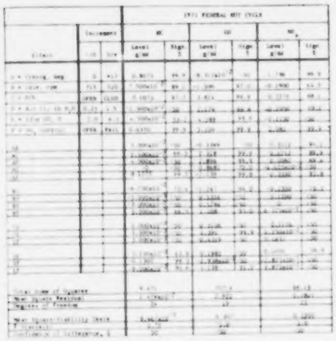
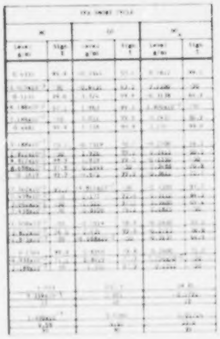
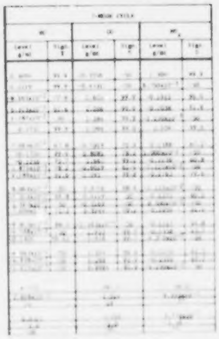
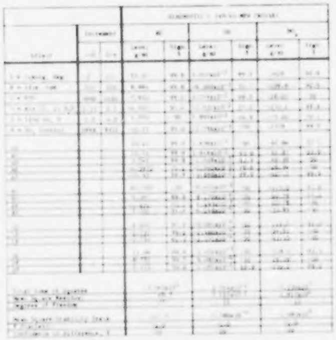


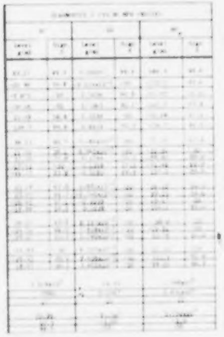
TABLE 2
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 808
1971 Toyota Corona Mark II

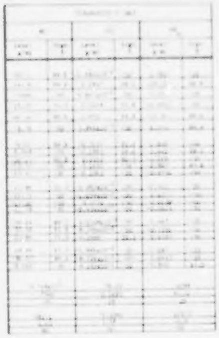

1971 FEDERAL HOT CYCLE
Effect
Increment
HC
CO
NOx
Level g/mi
Sign %
Total Sums of Squares
Mean Square Residual
Degrees of Freedom
Mean Square-Stability Check
F Statistic
Confidence of Difference, %











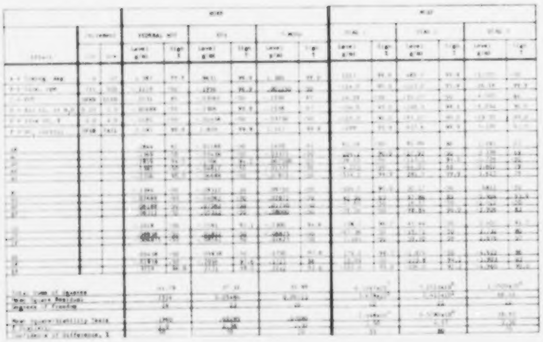
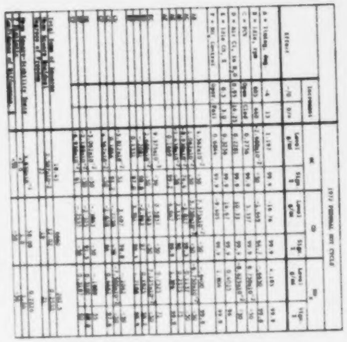
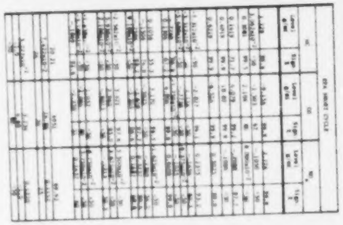
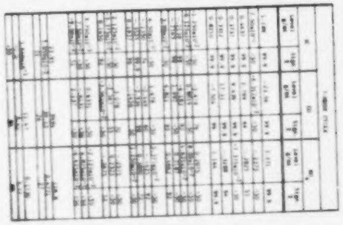


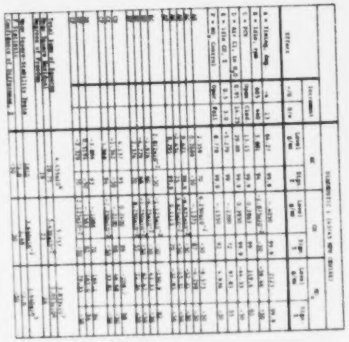
TABLE 2

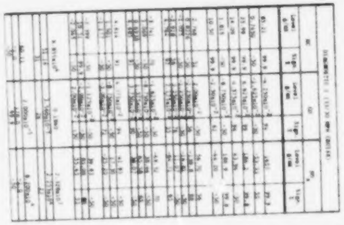
SUMMARY OF ORTHOGONAL ANALYSIS DATA
Vehicle 809
1971 Chevrolet Monte Carlo

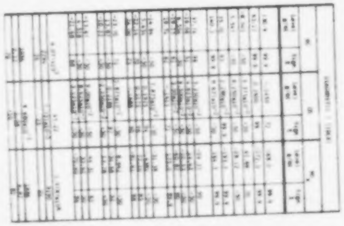


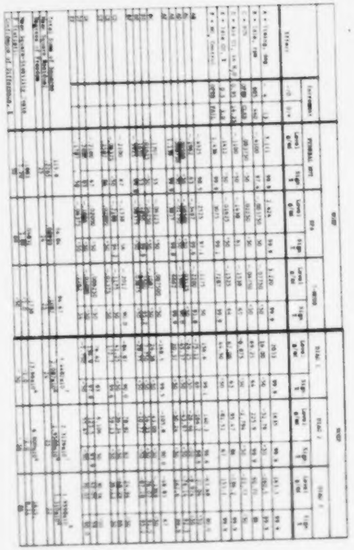












APPENDIX C

DETROIT ENGINE PARAMETER STUDY

FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

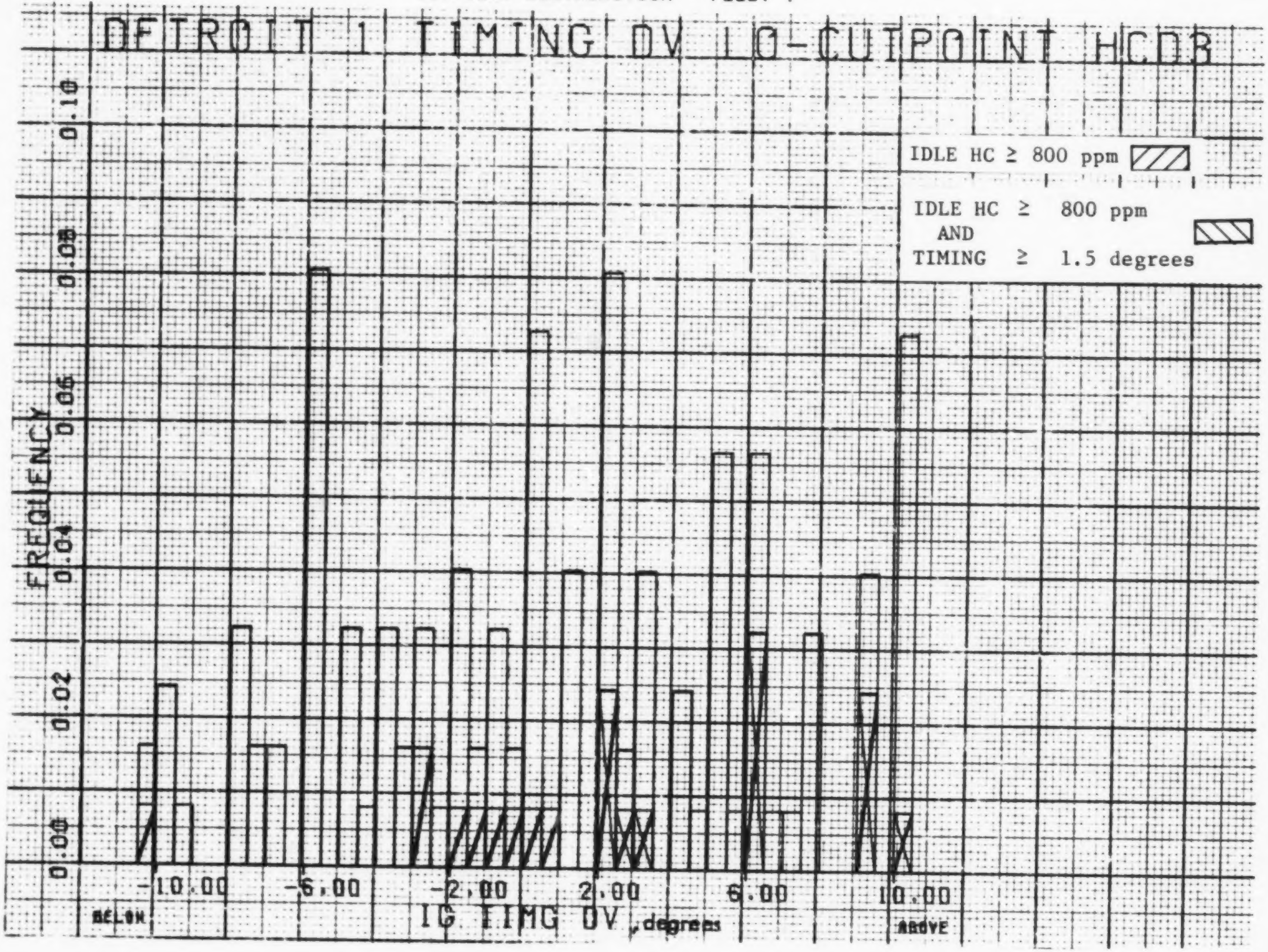


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

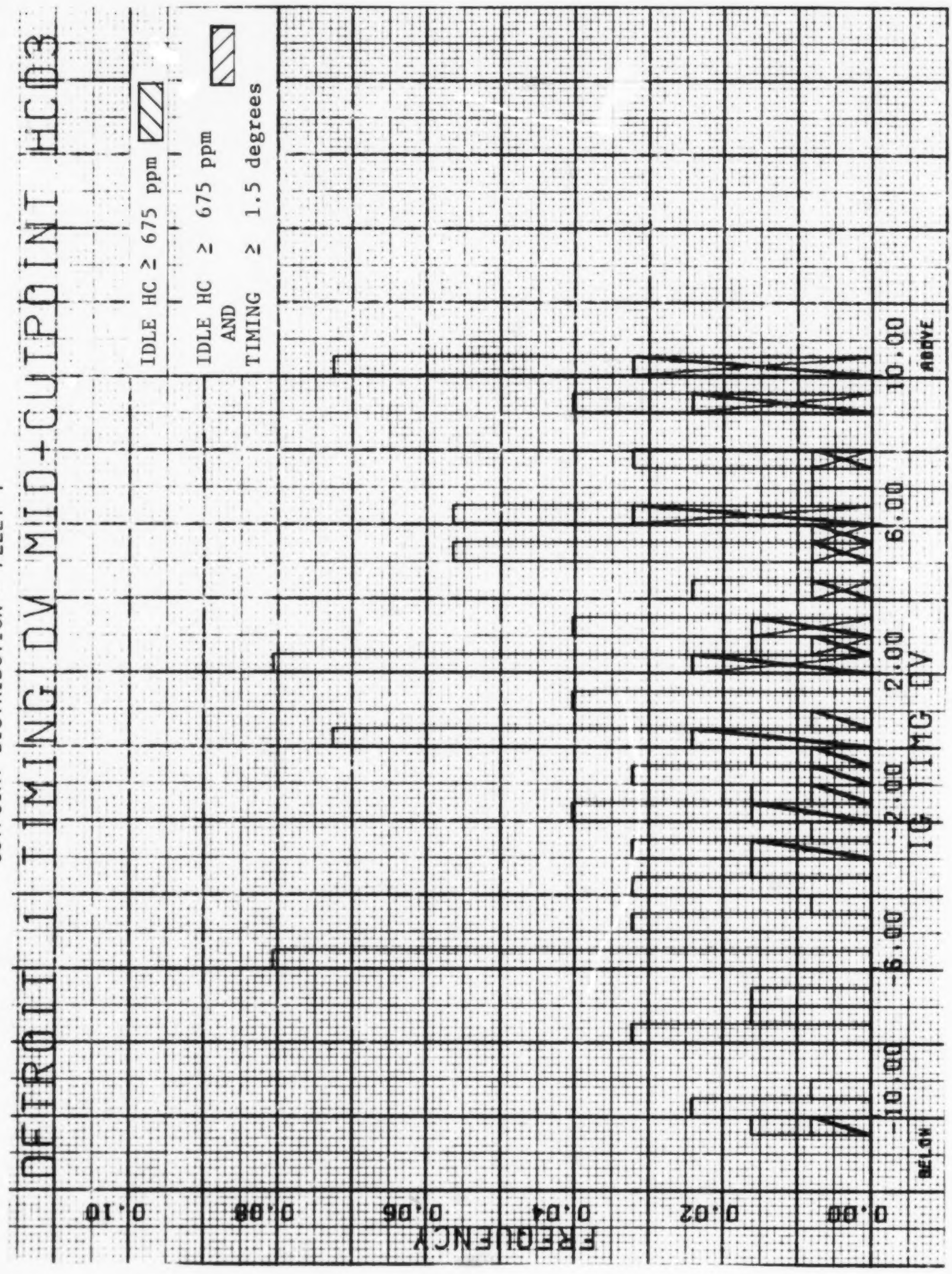


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

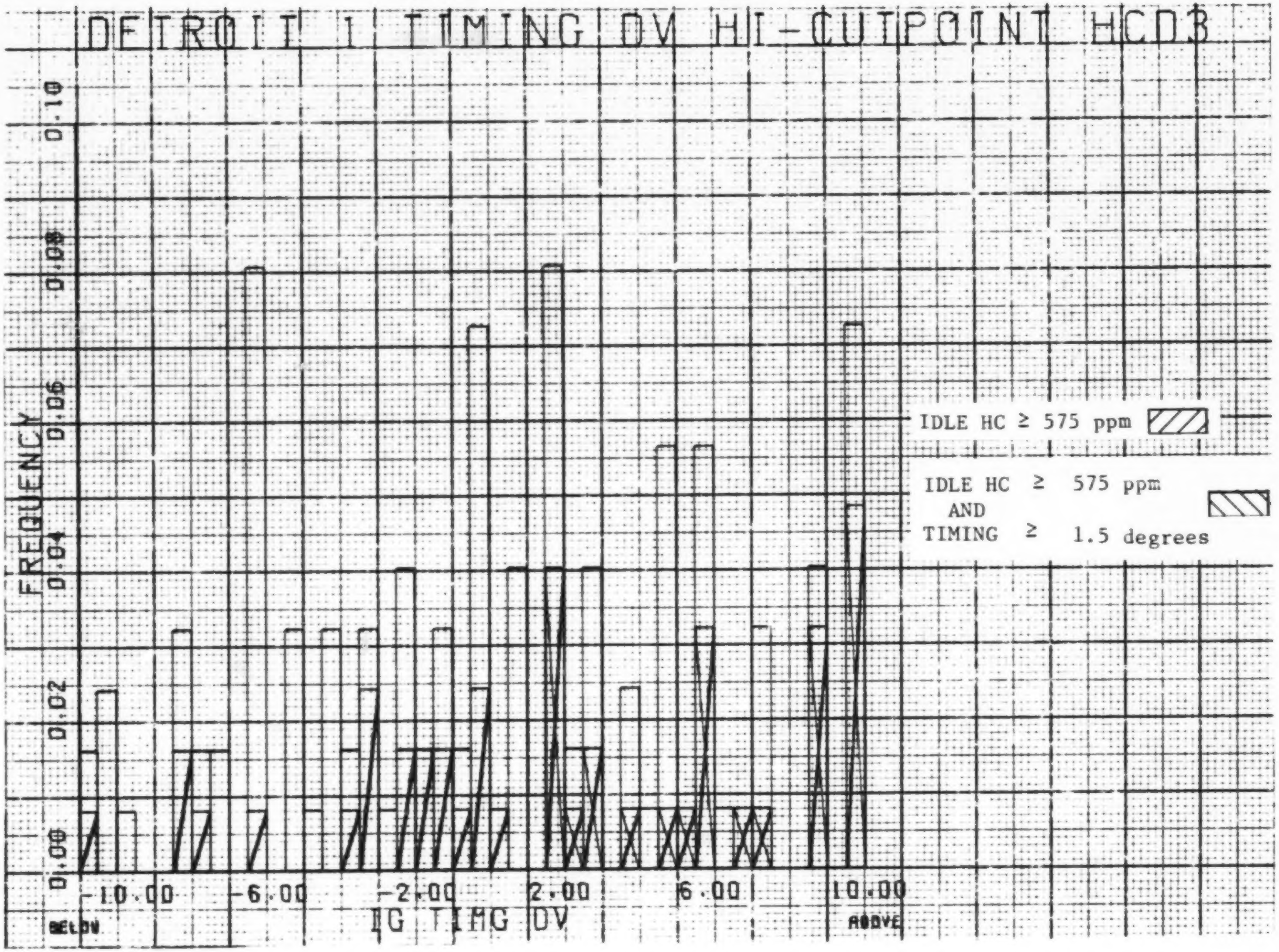


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

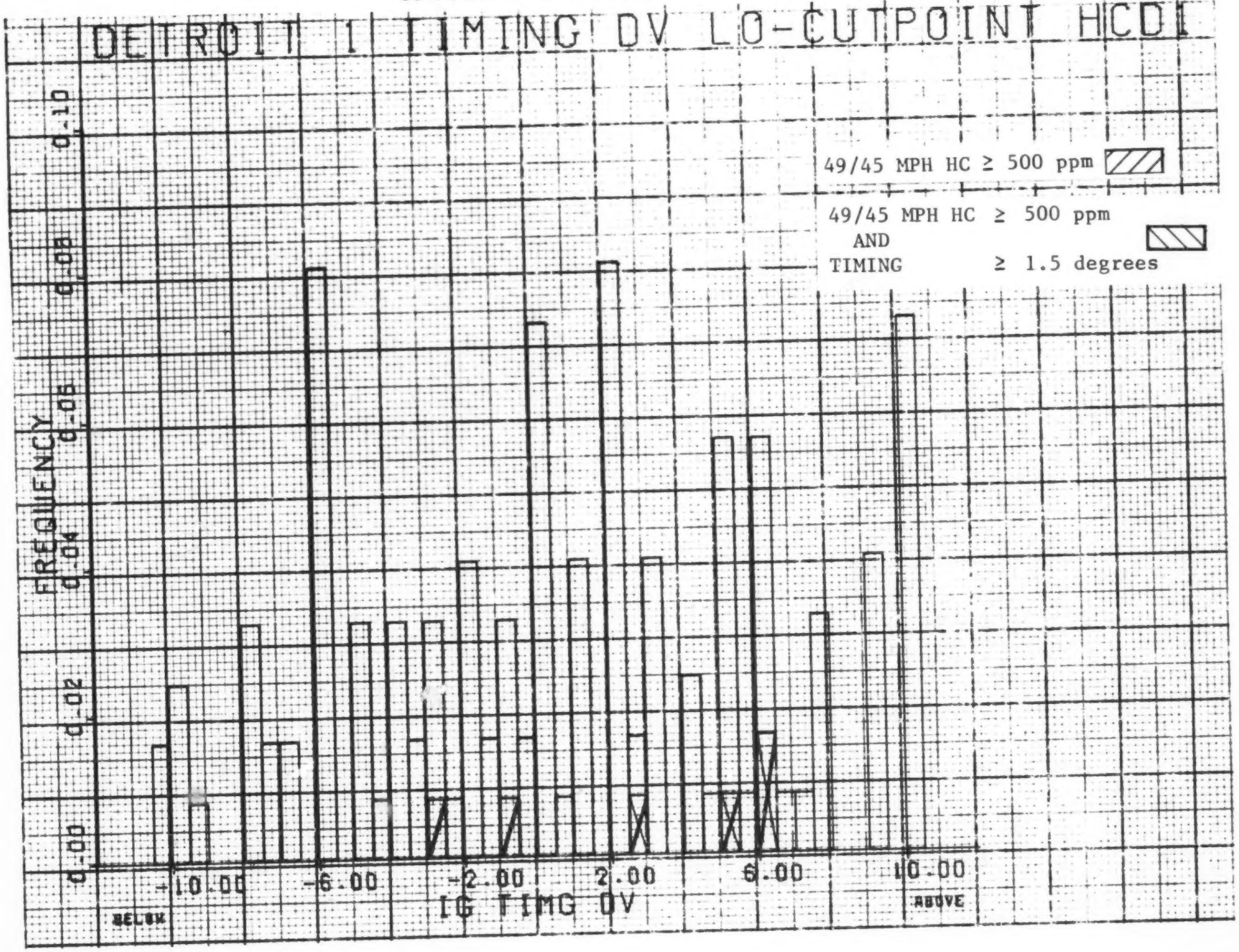


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

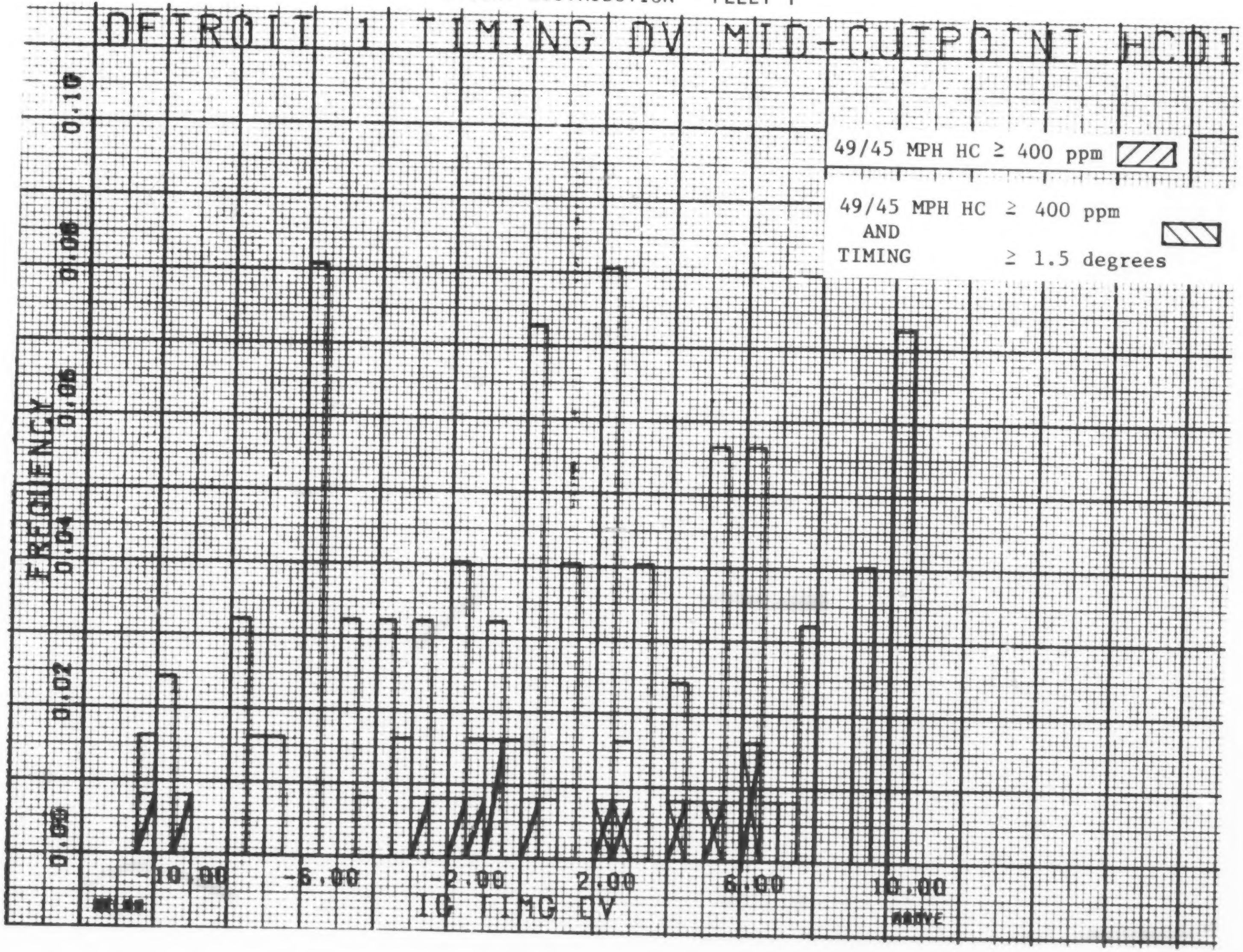


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

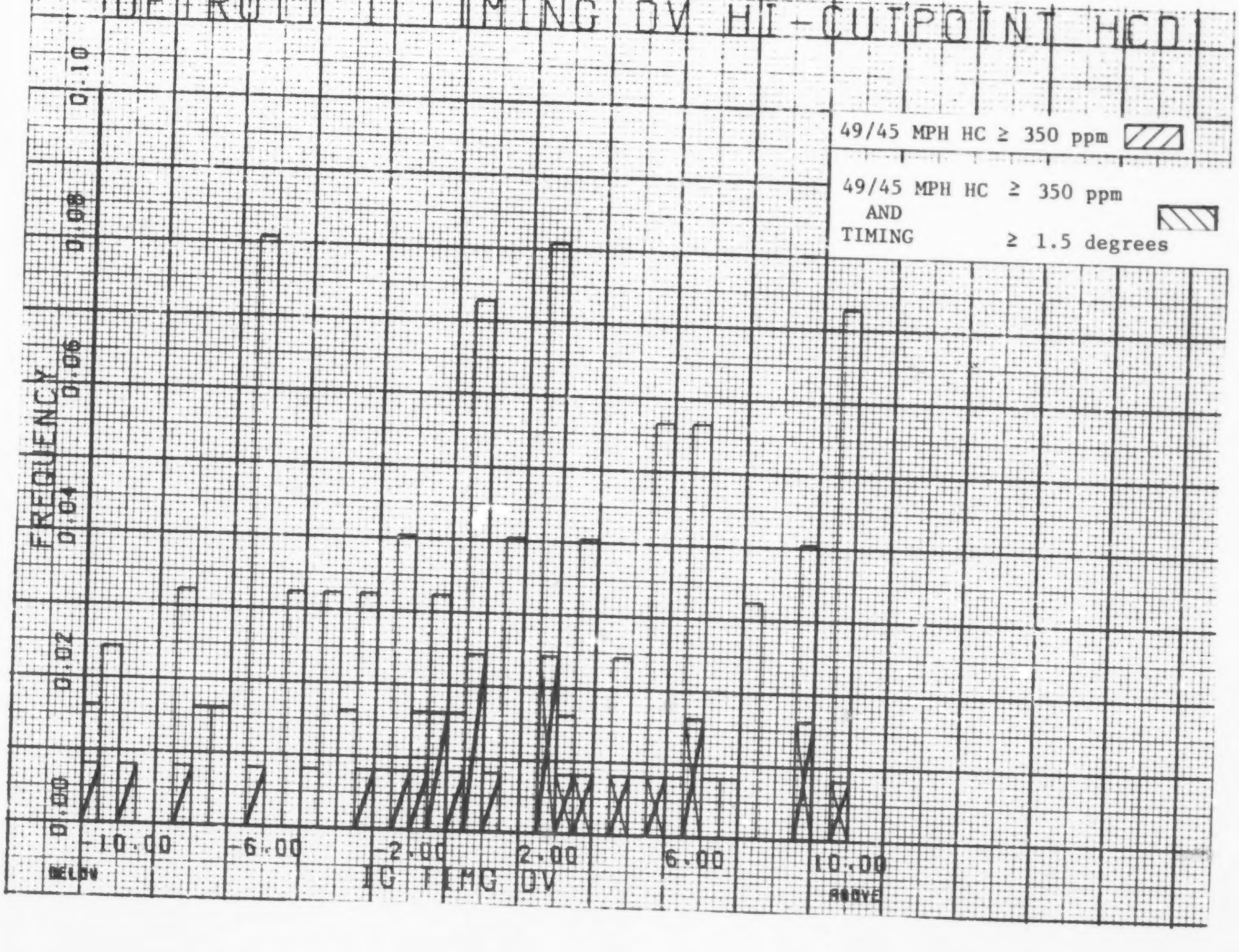


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

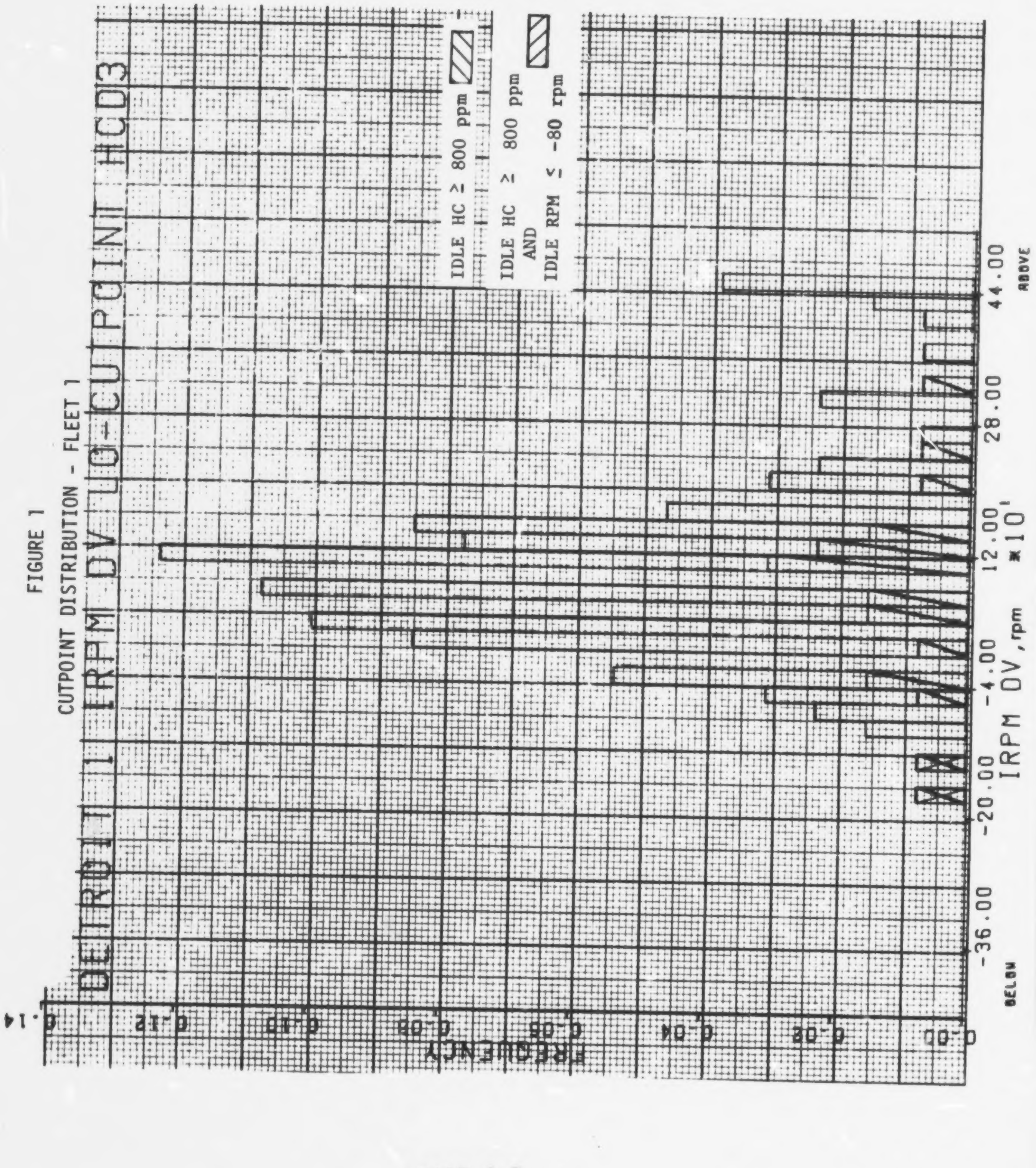


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

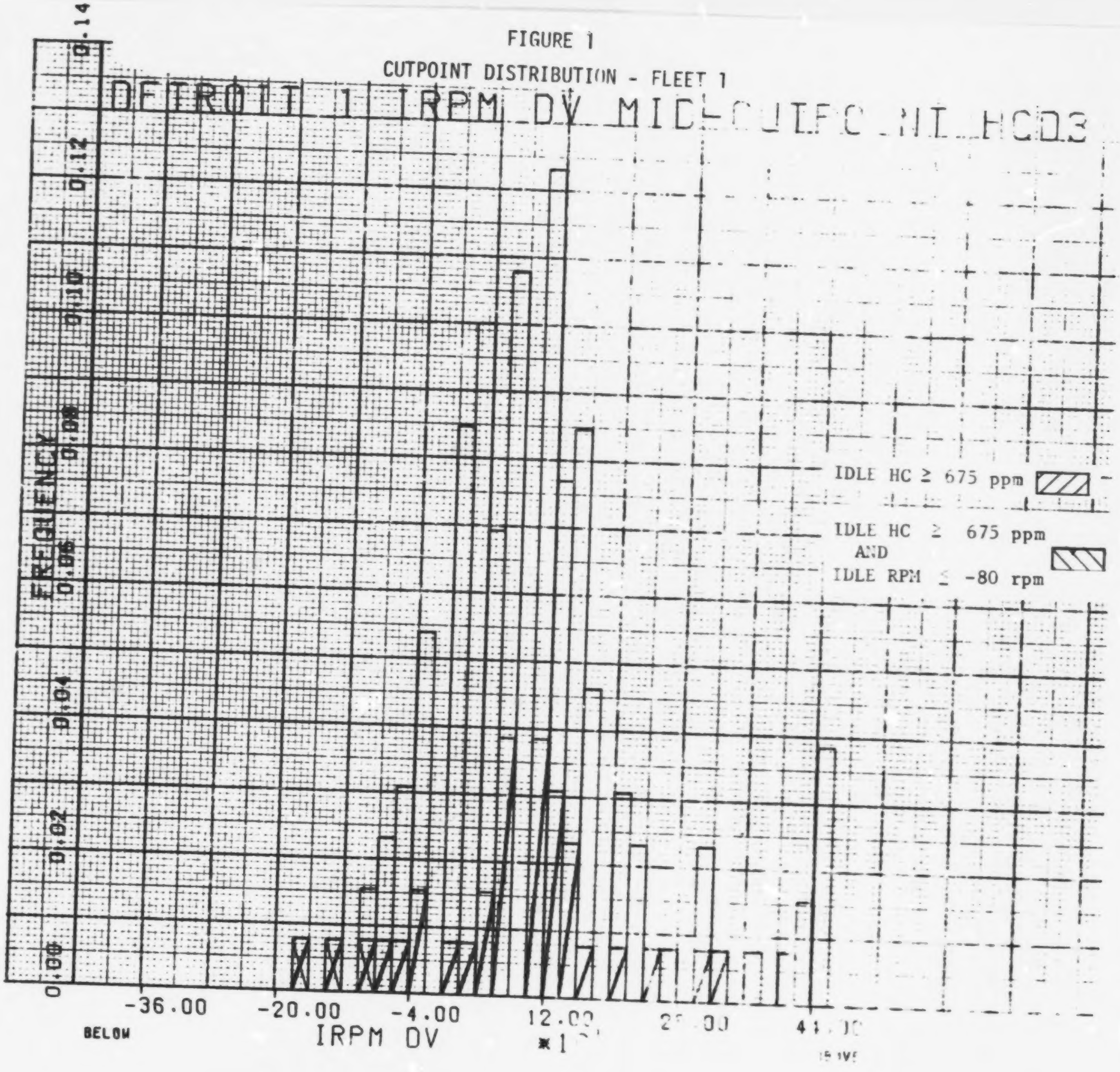


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

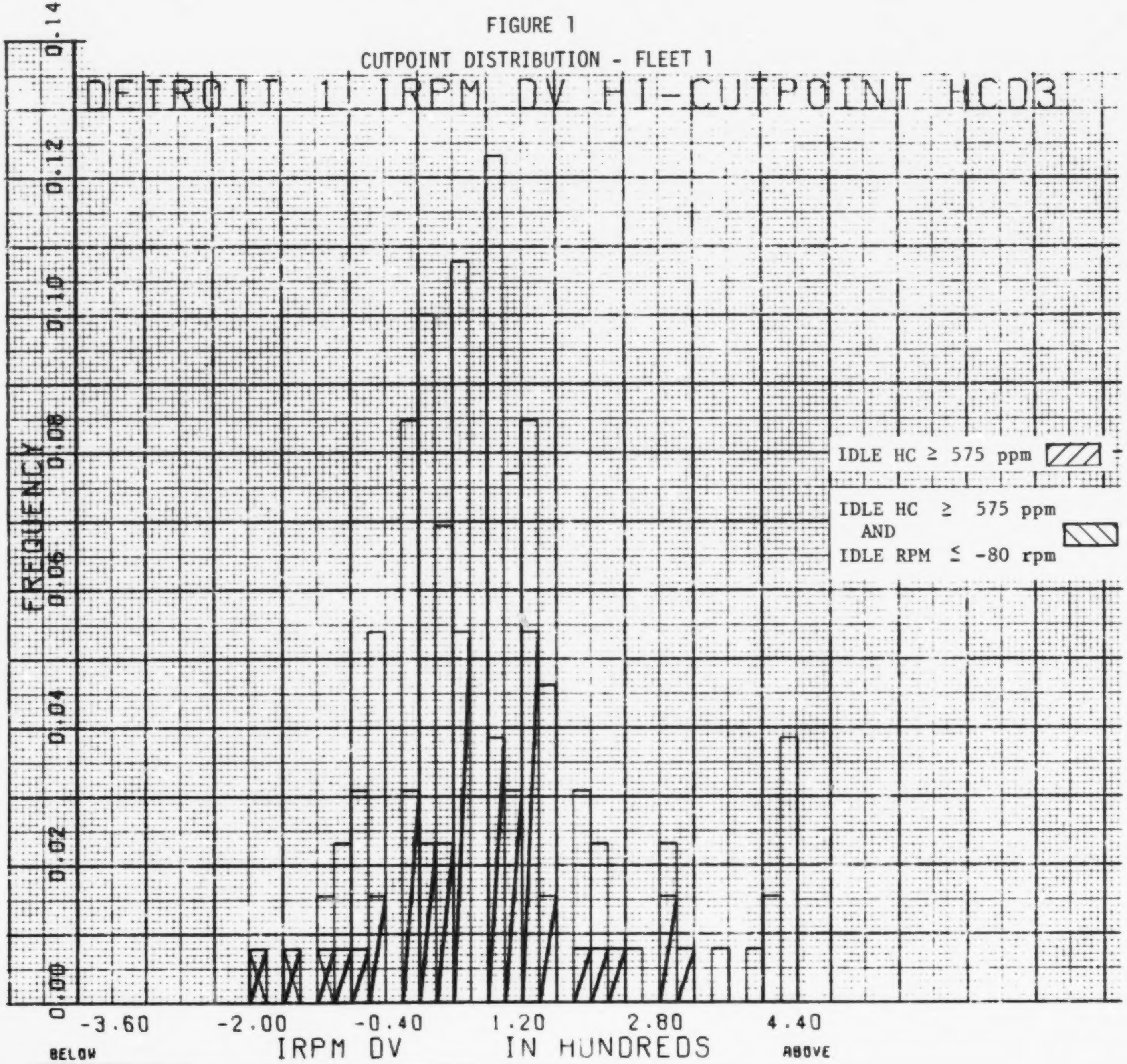


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

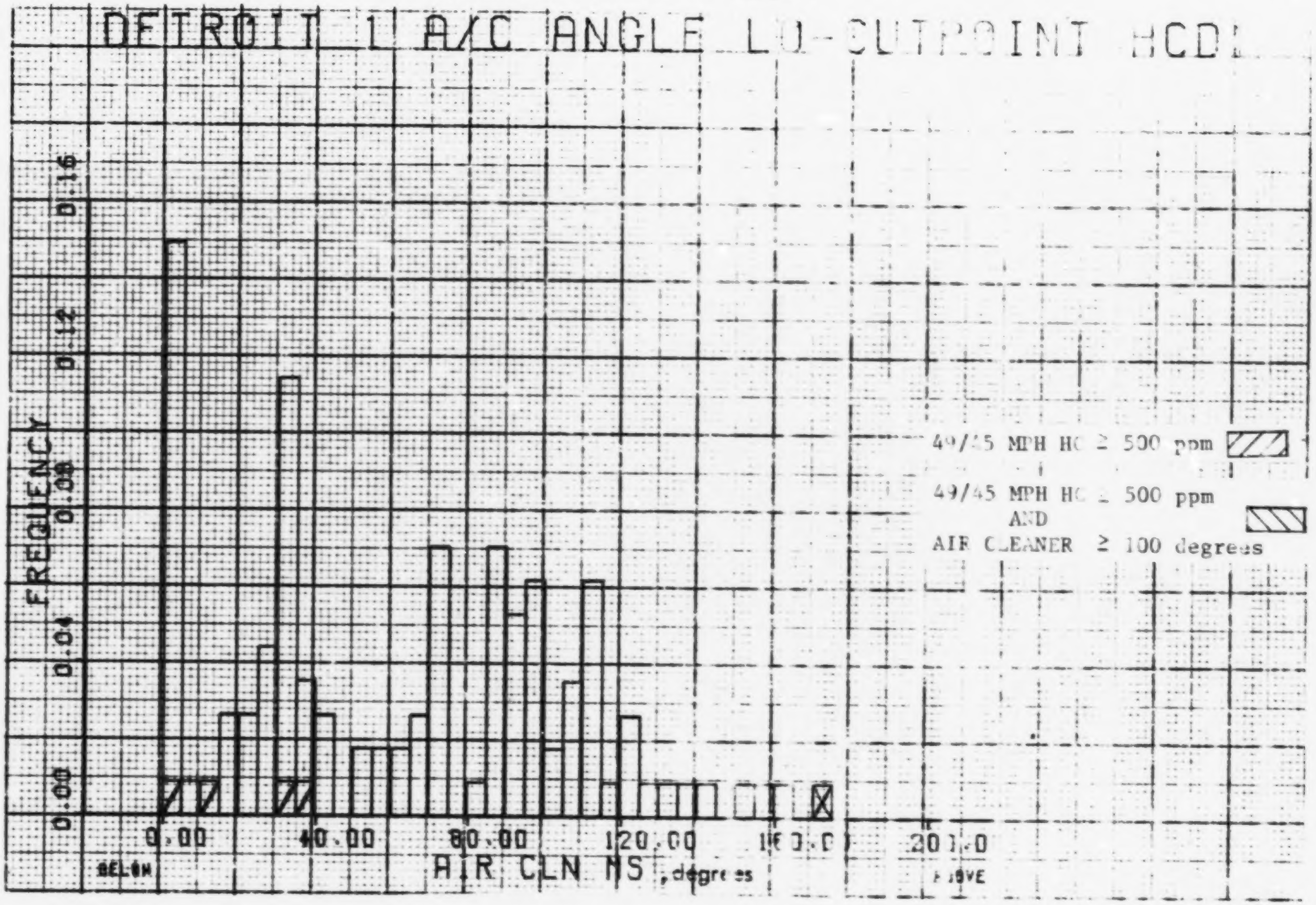


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

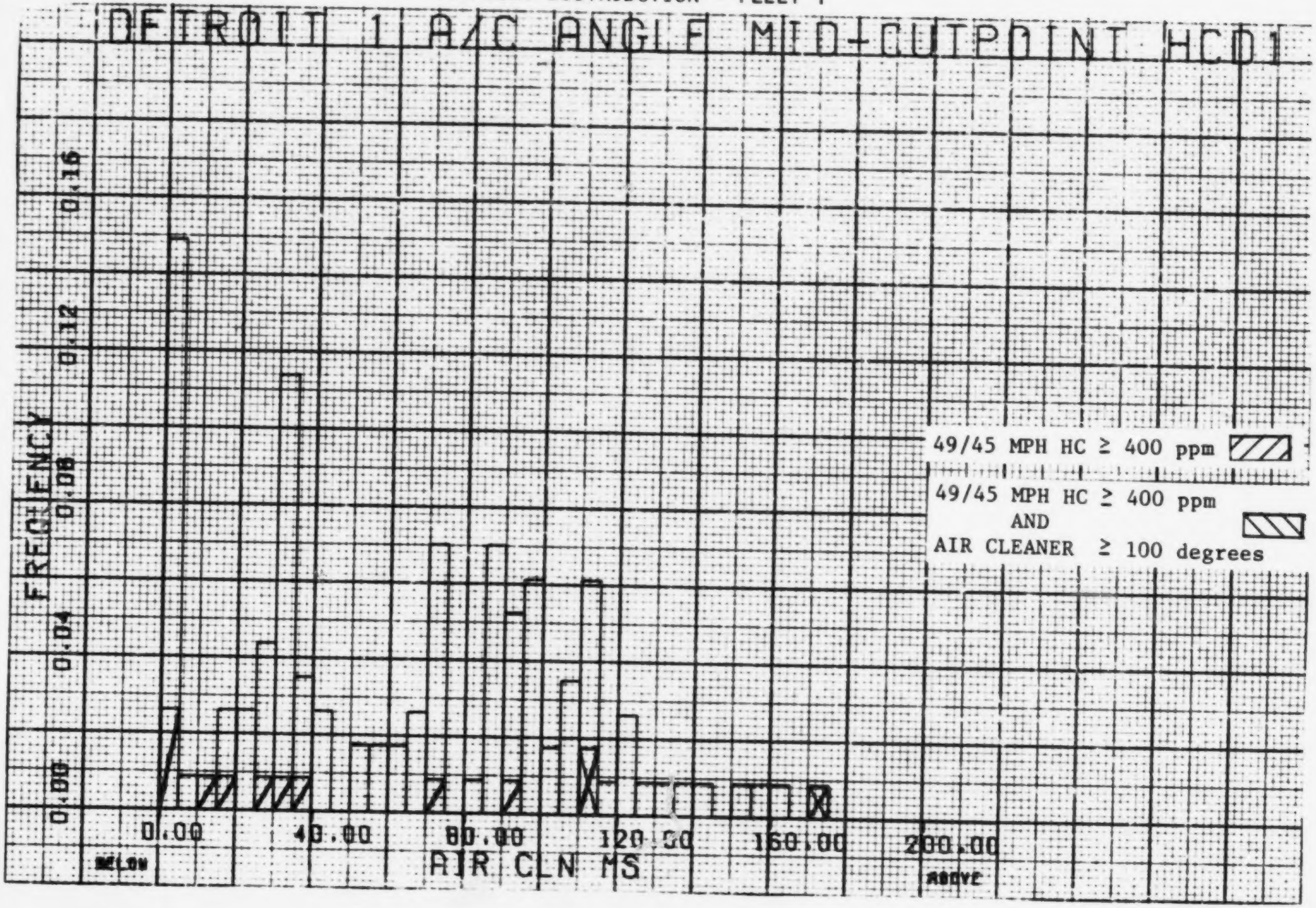


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

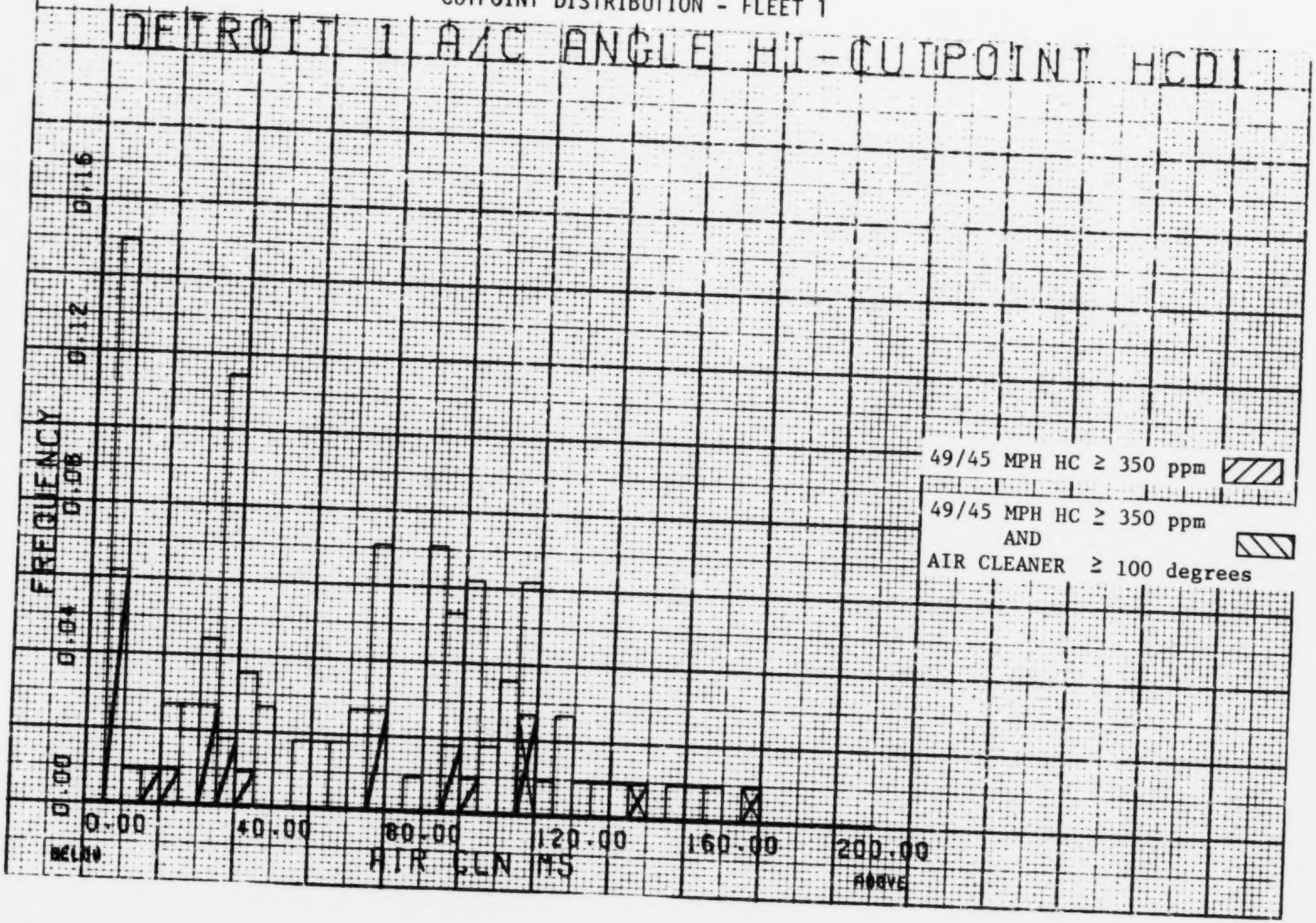


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

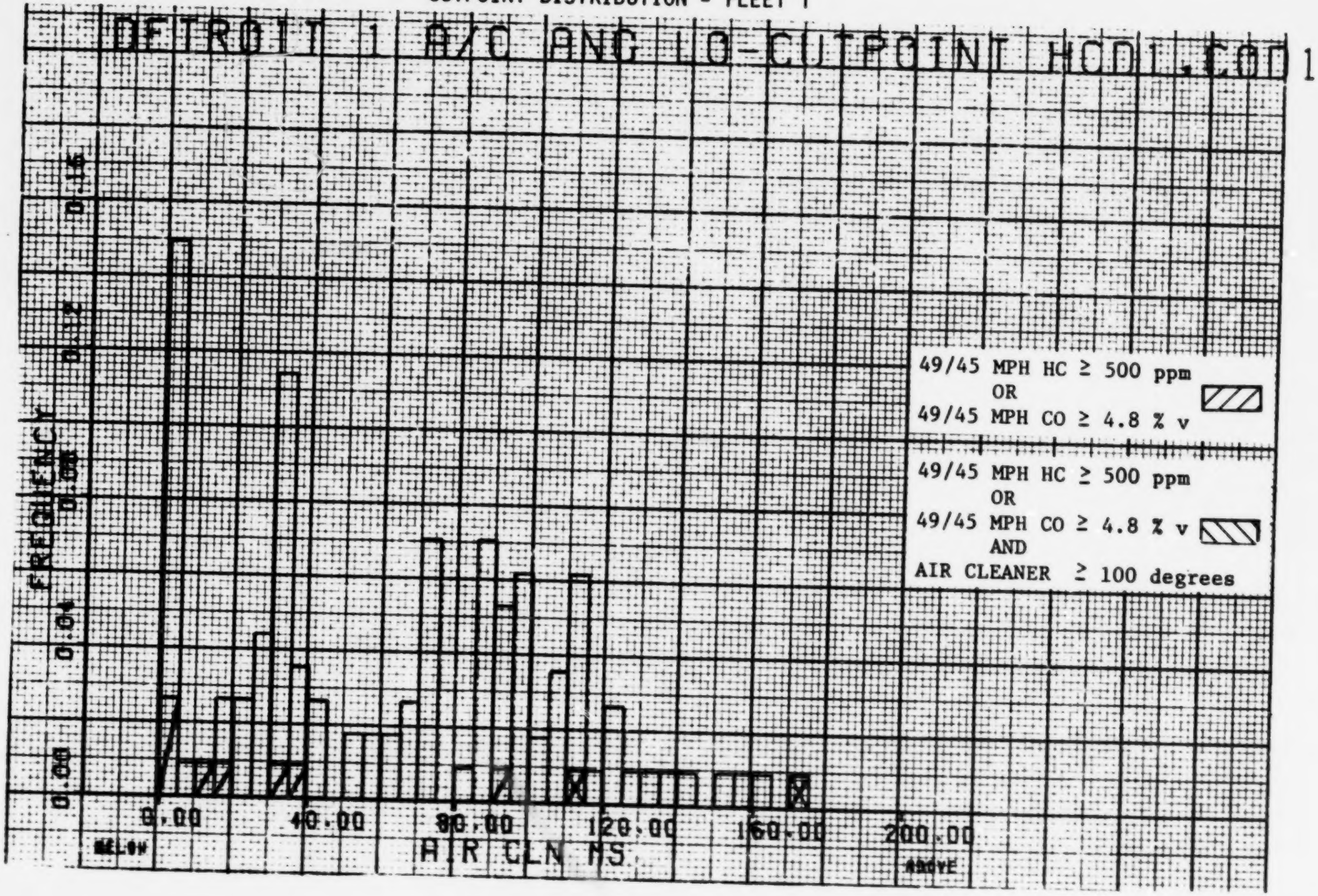


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

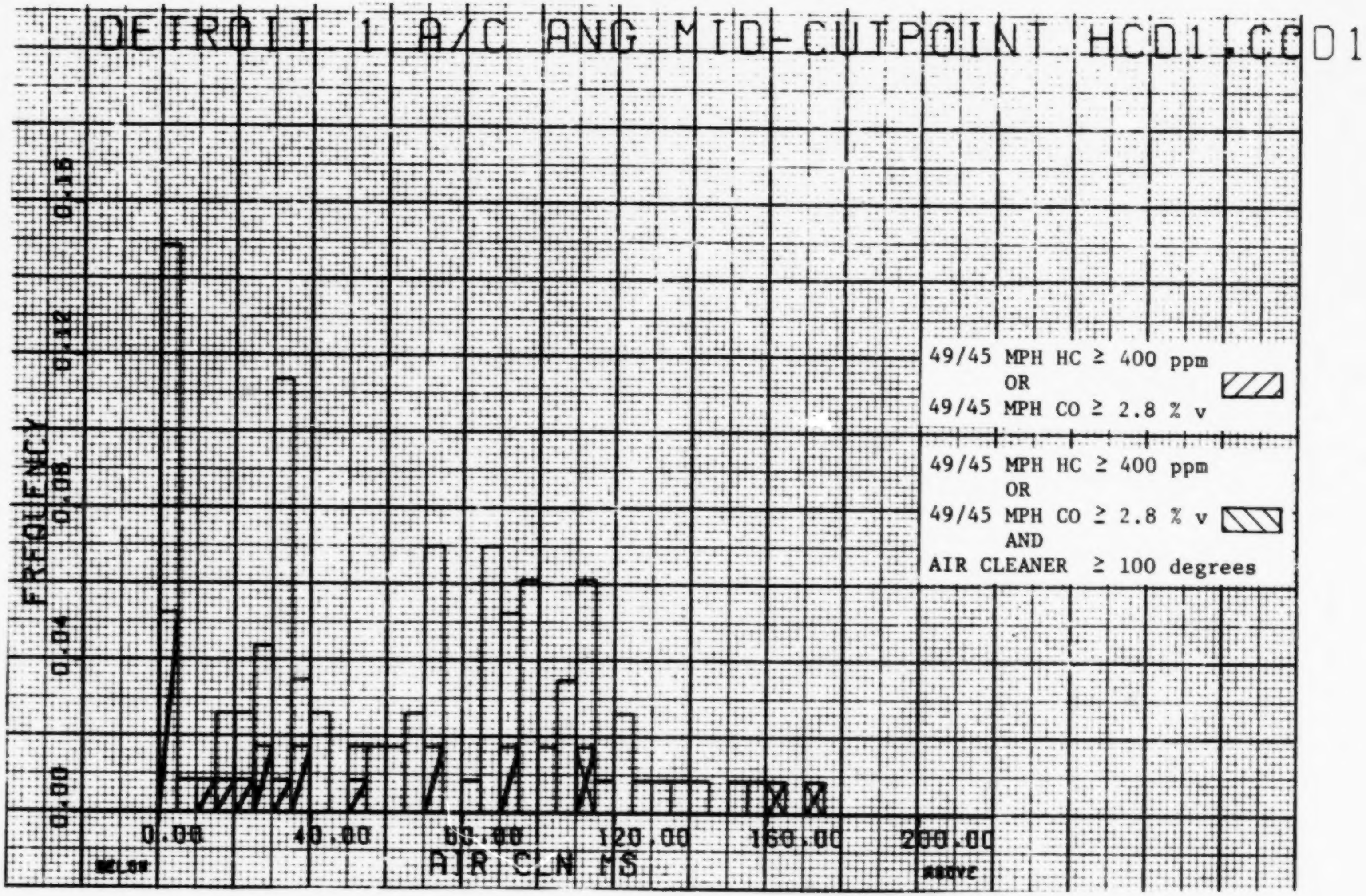


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

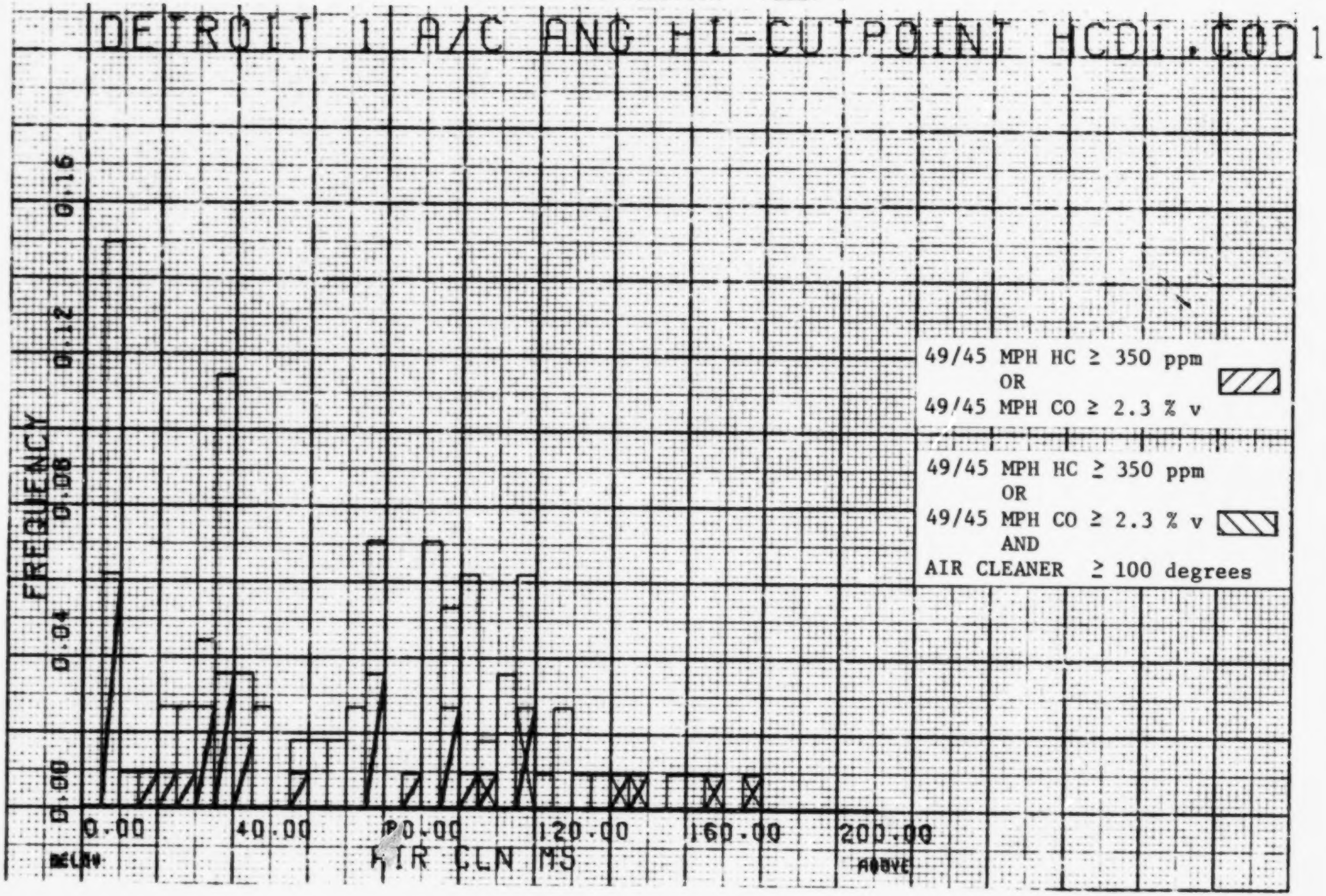


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

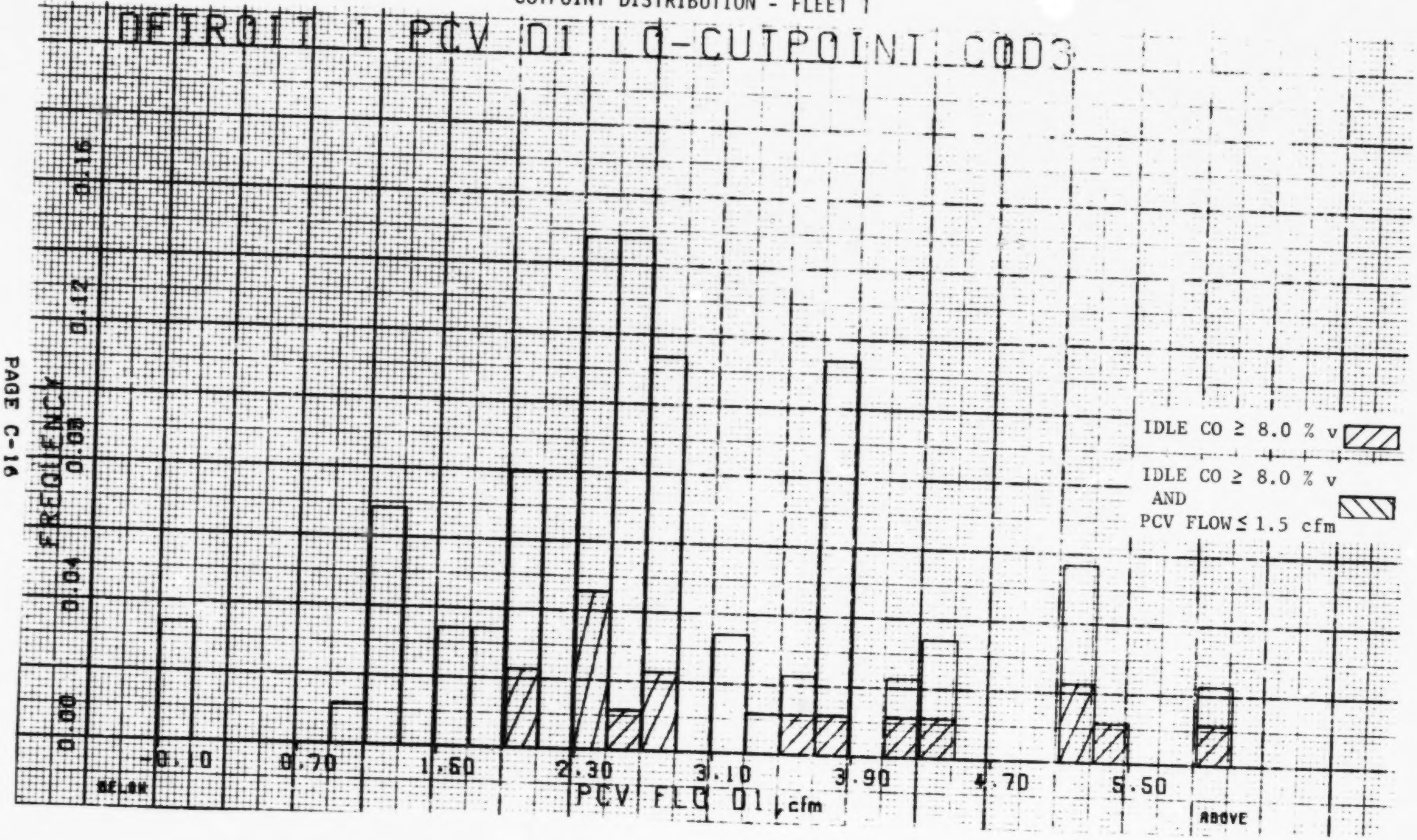


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

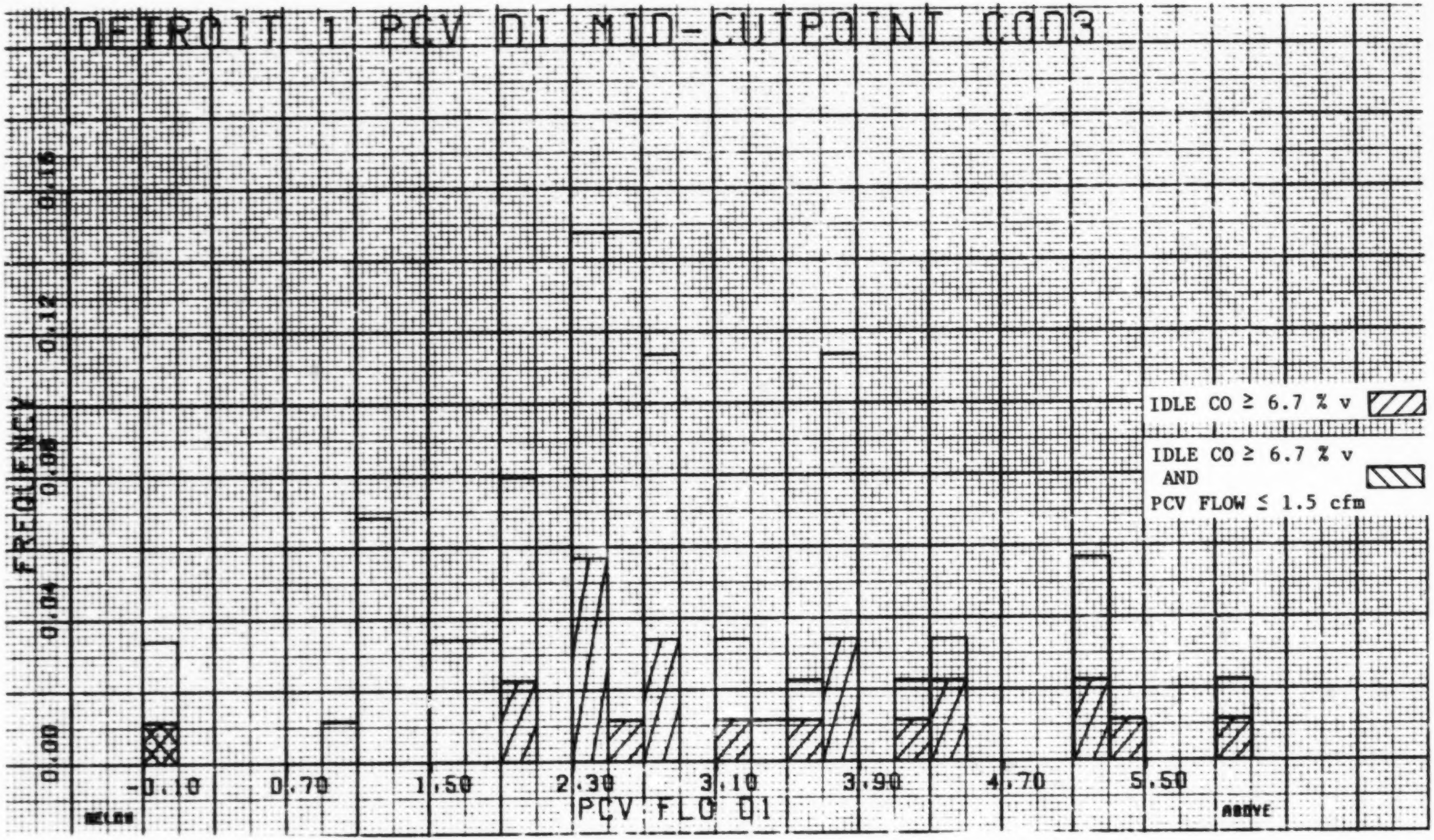


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

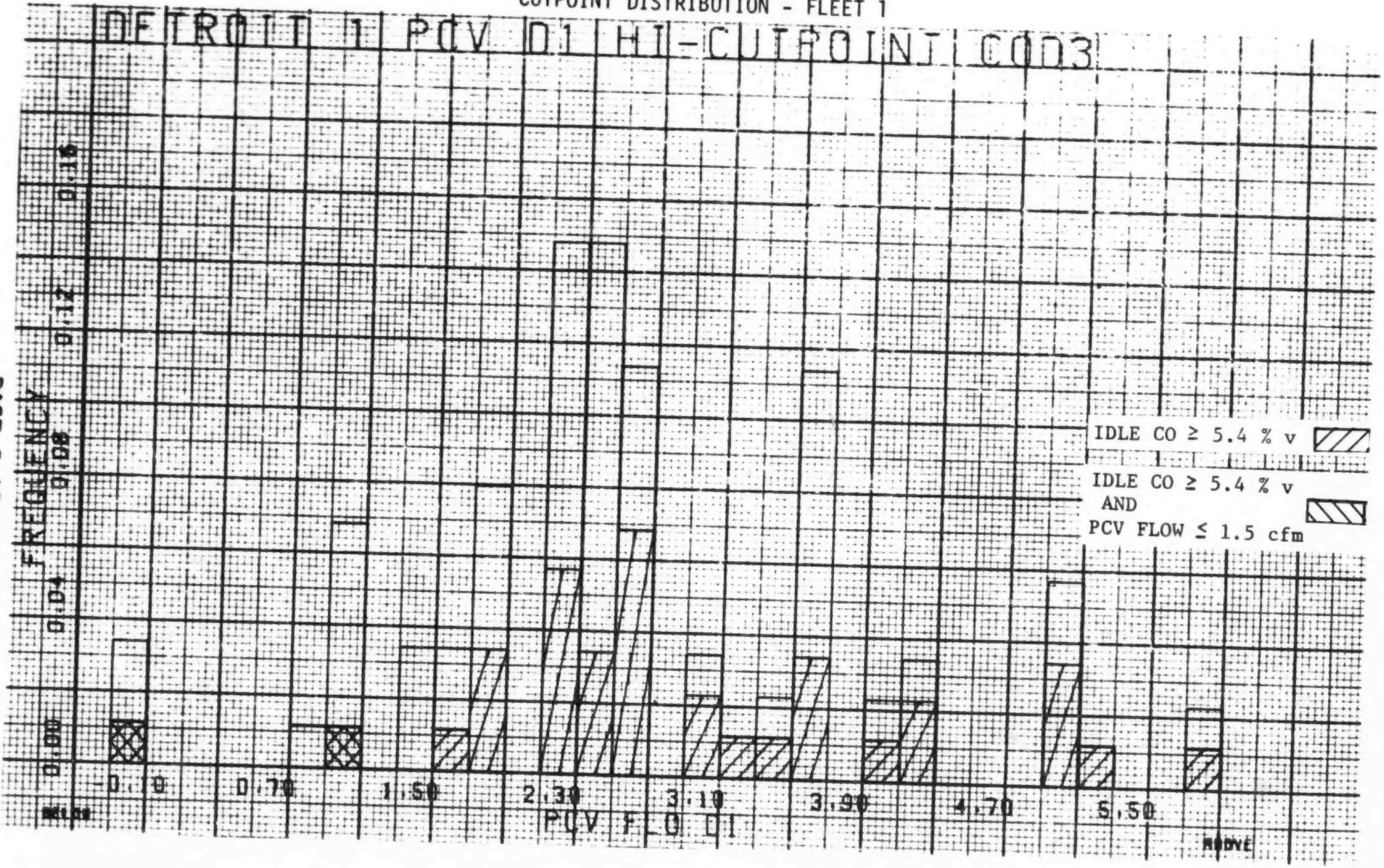


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

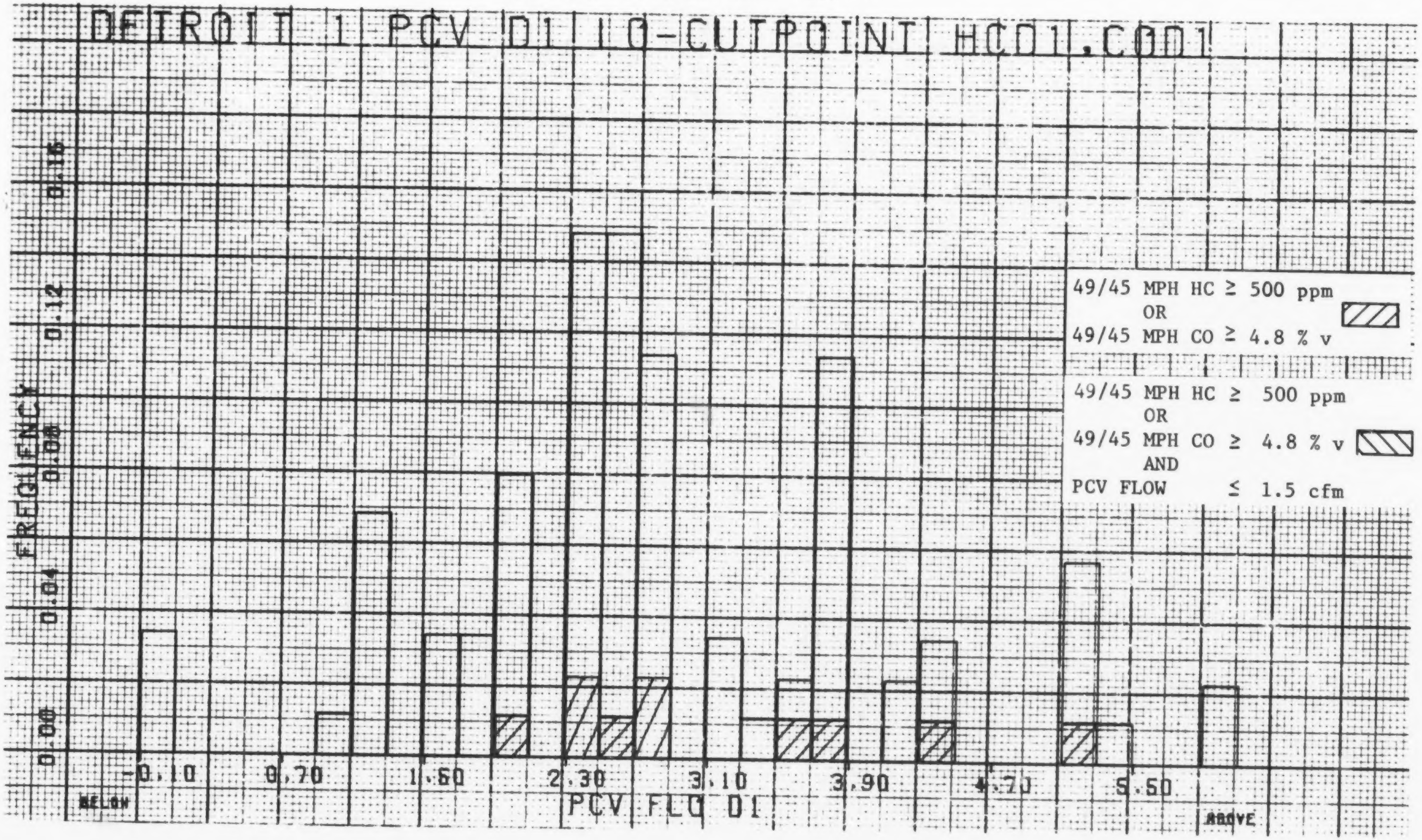


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

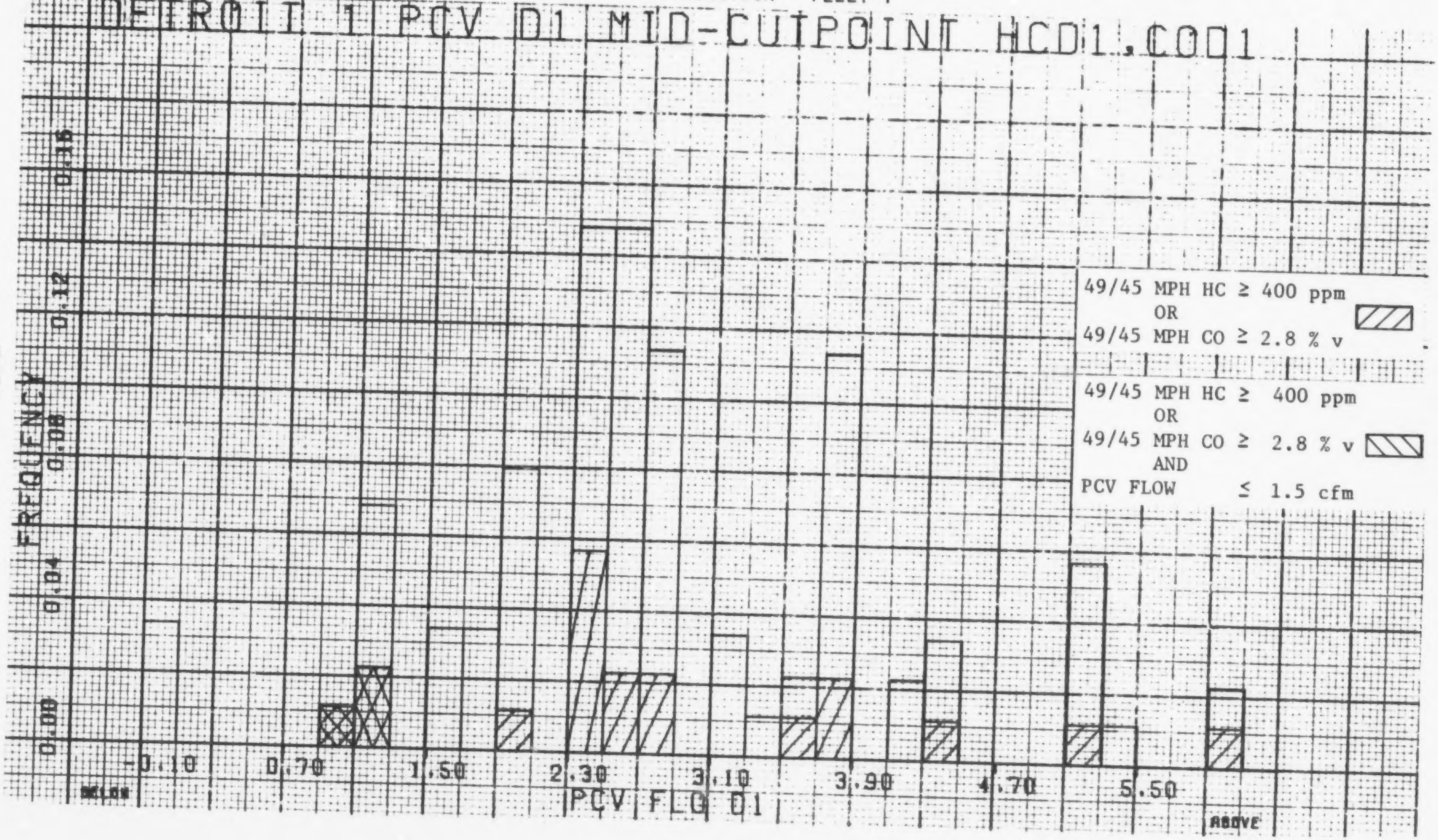


FIGURE 1

CUTPOINT DISTRIBUTION - FLEET 1

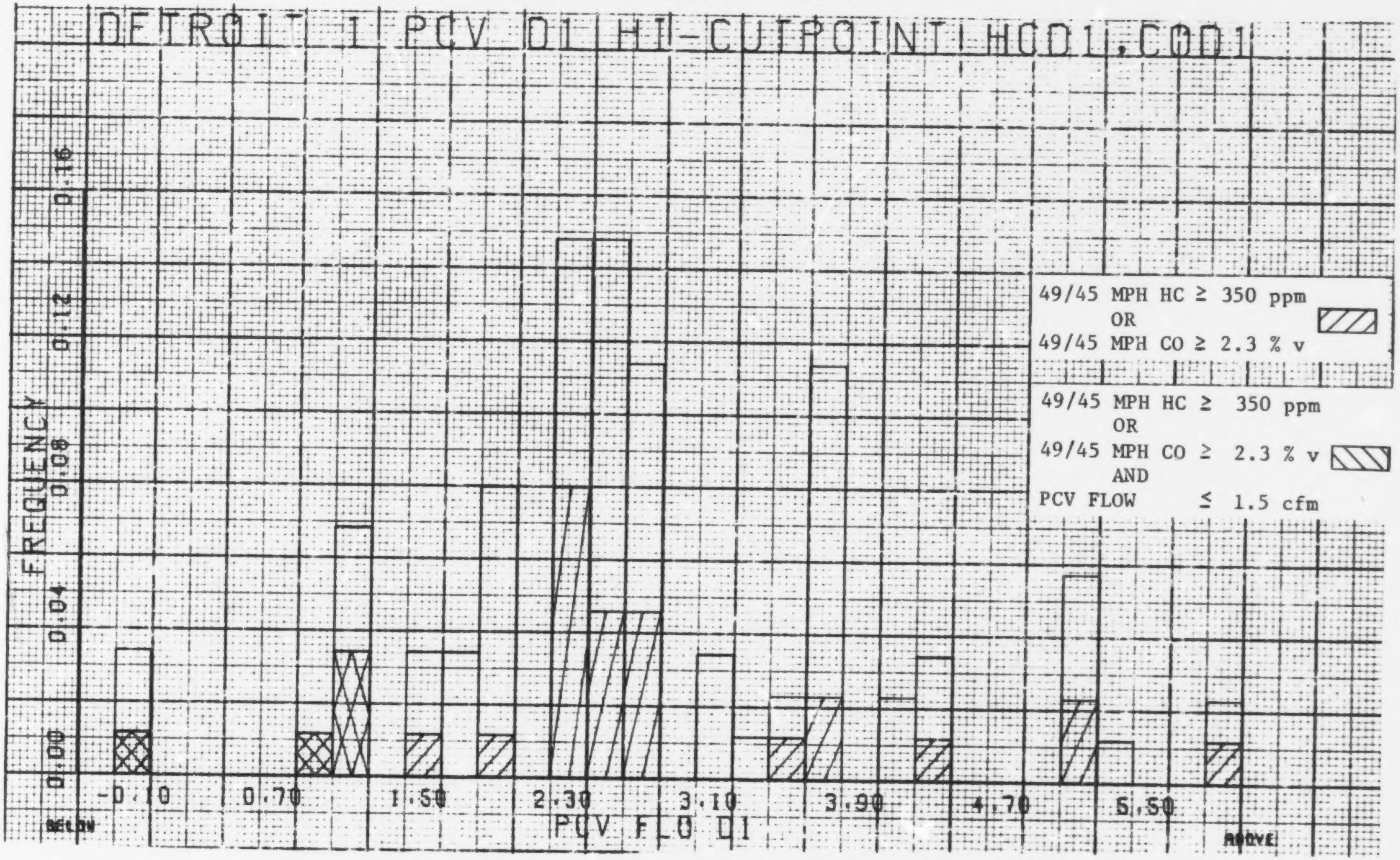


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

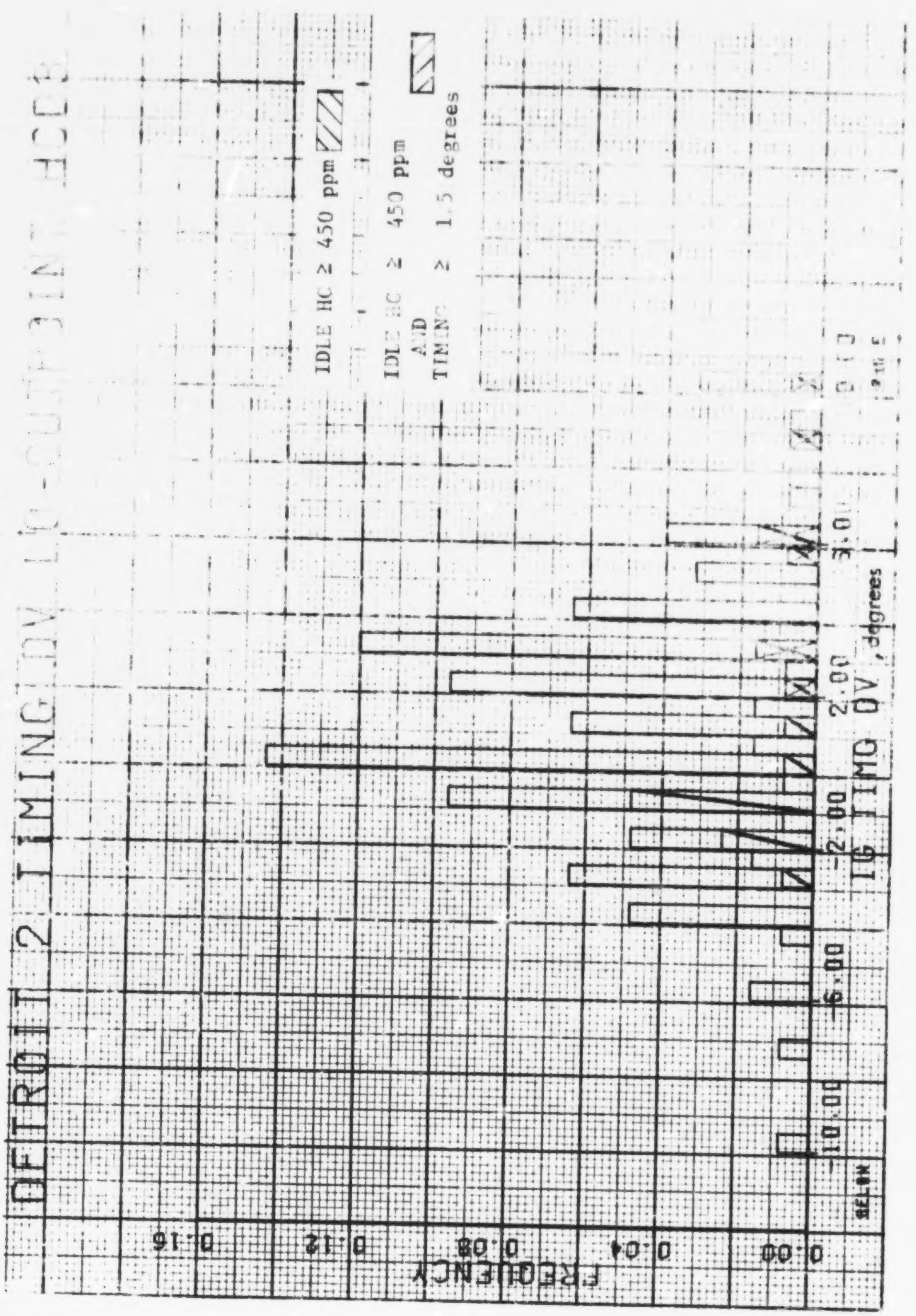


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

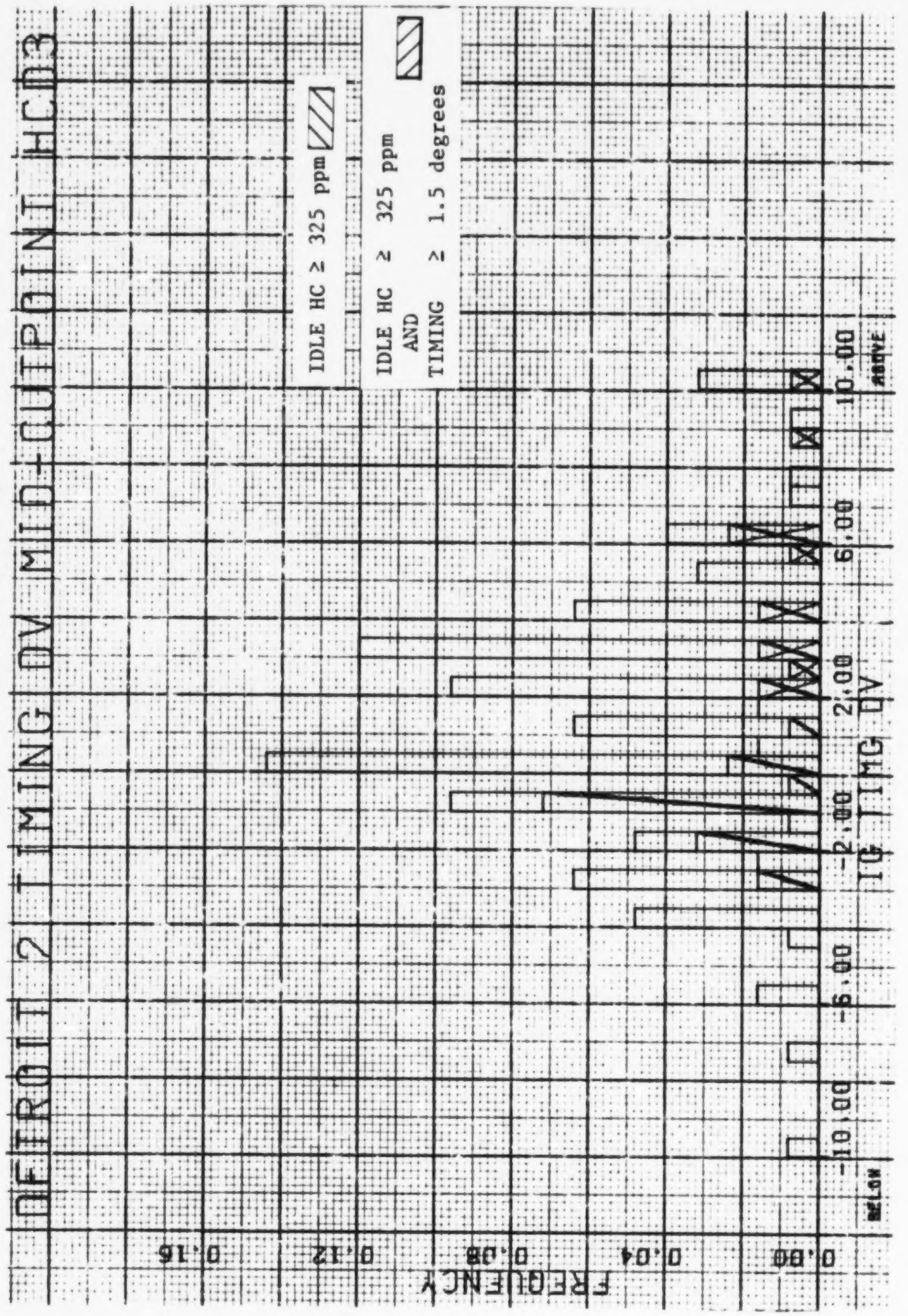


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

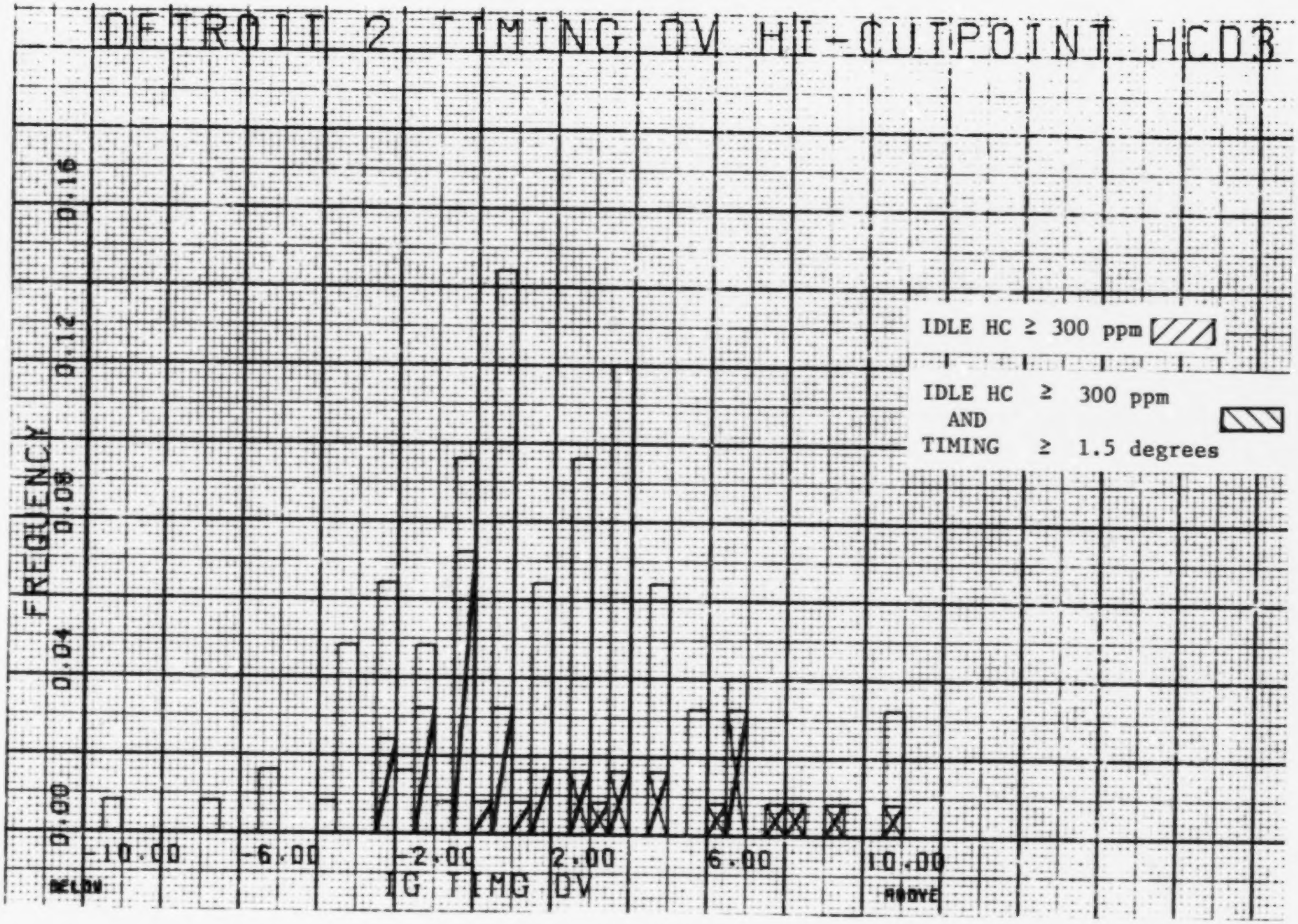


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

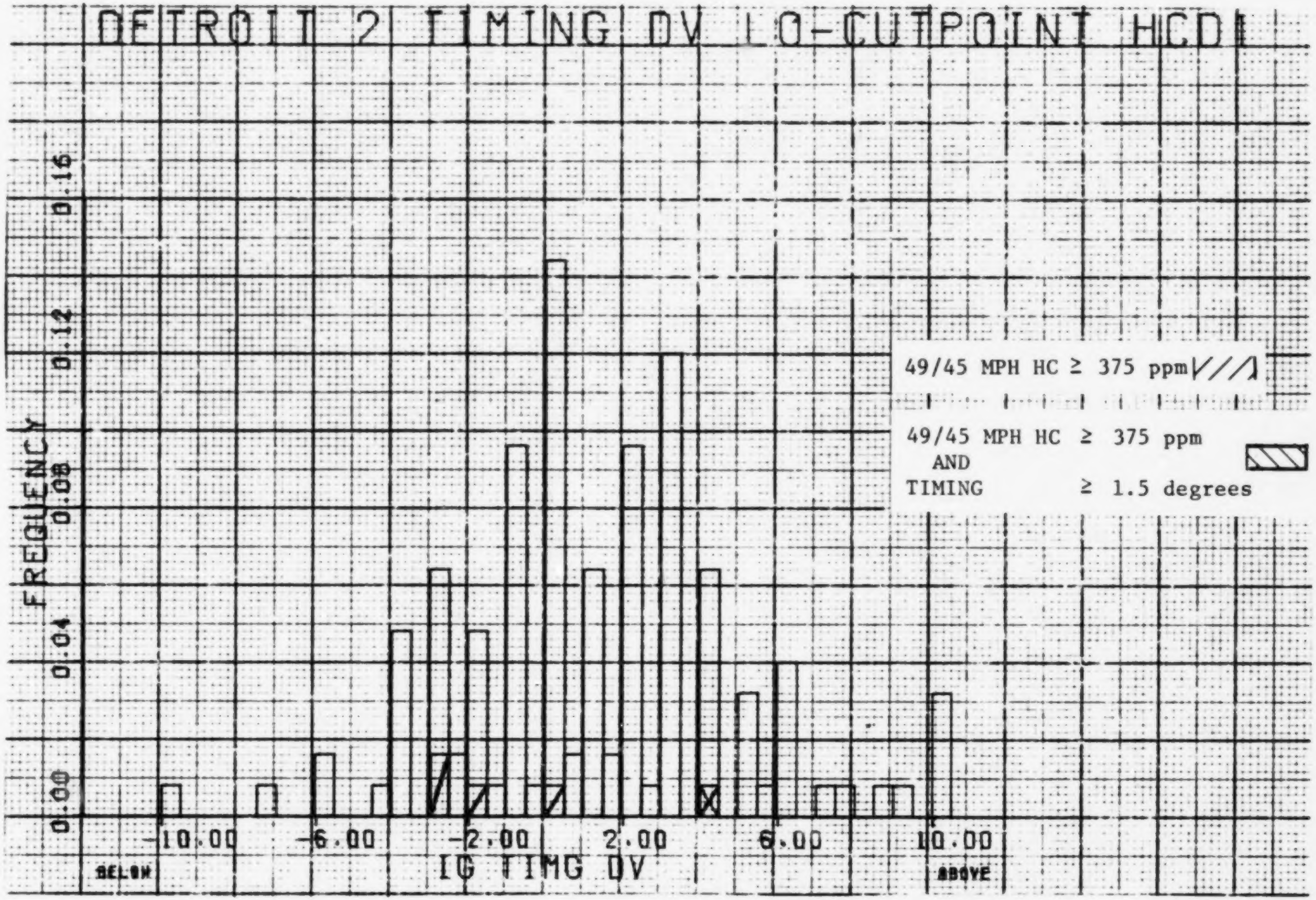


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

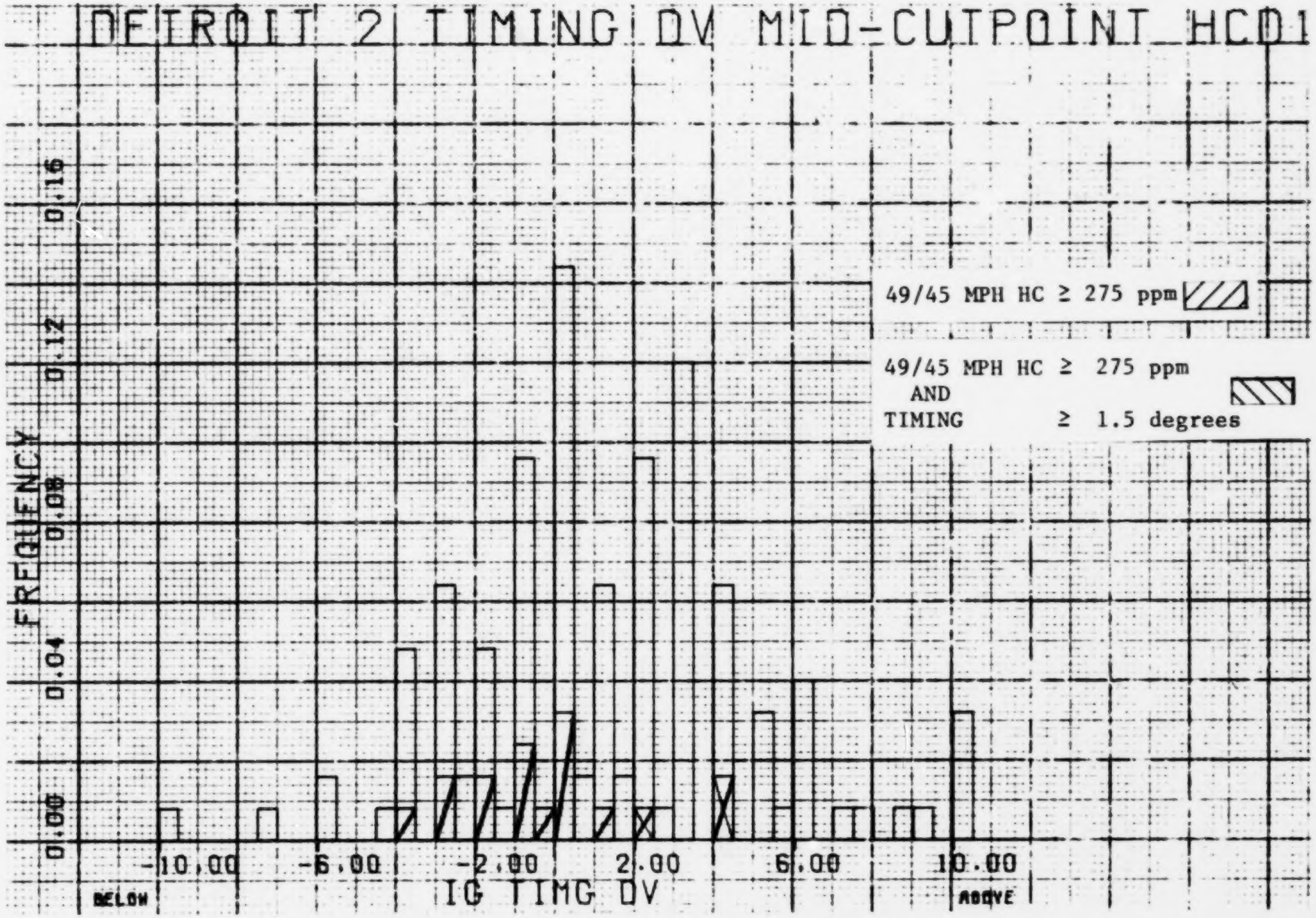


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

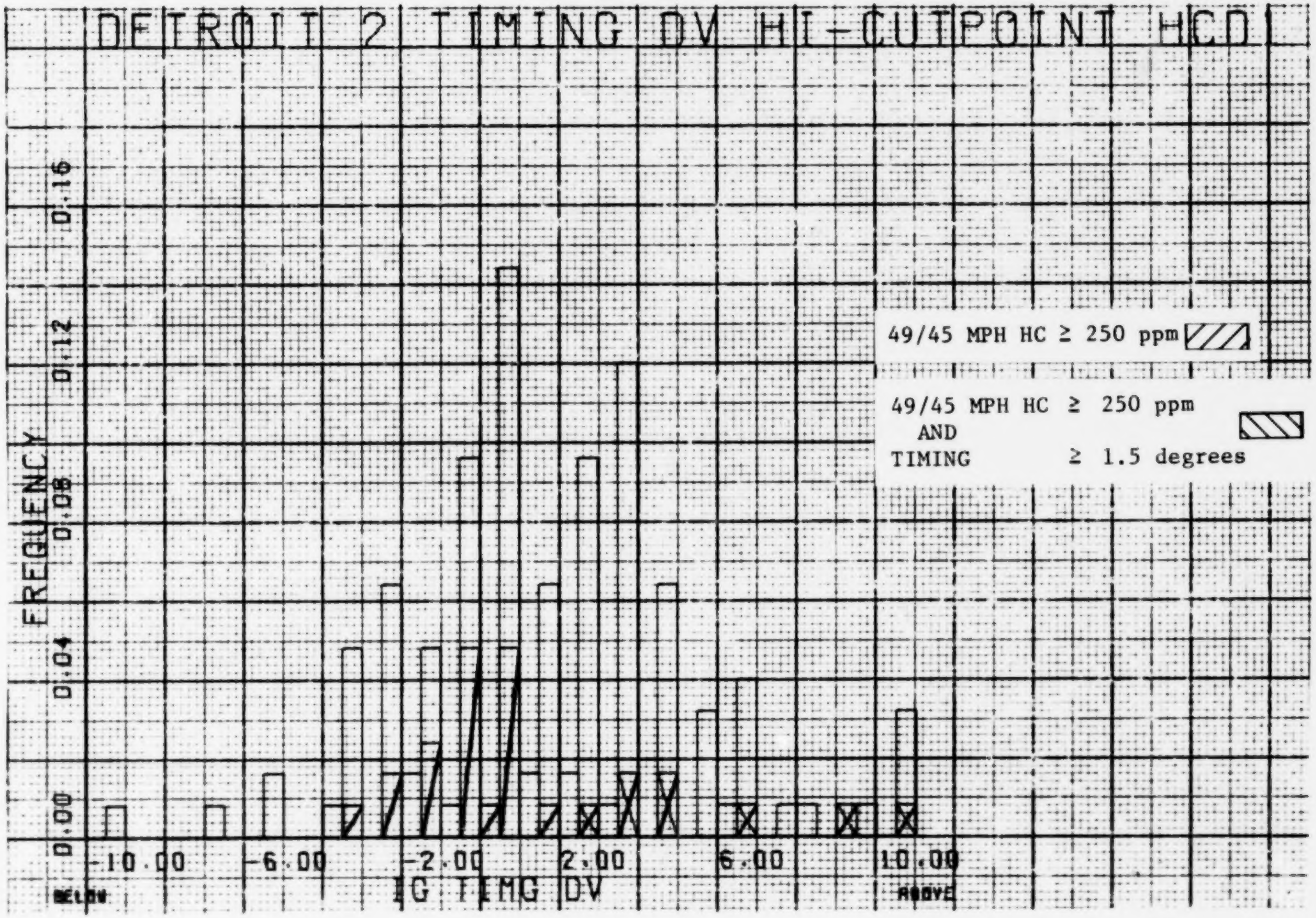


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

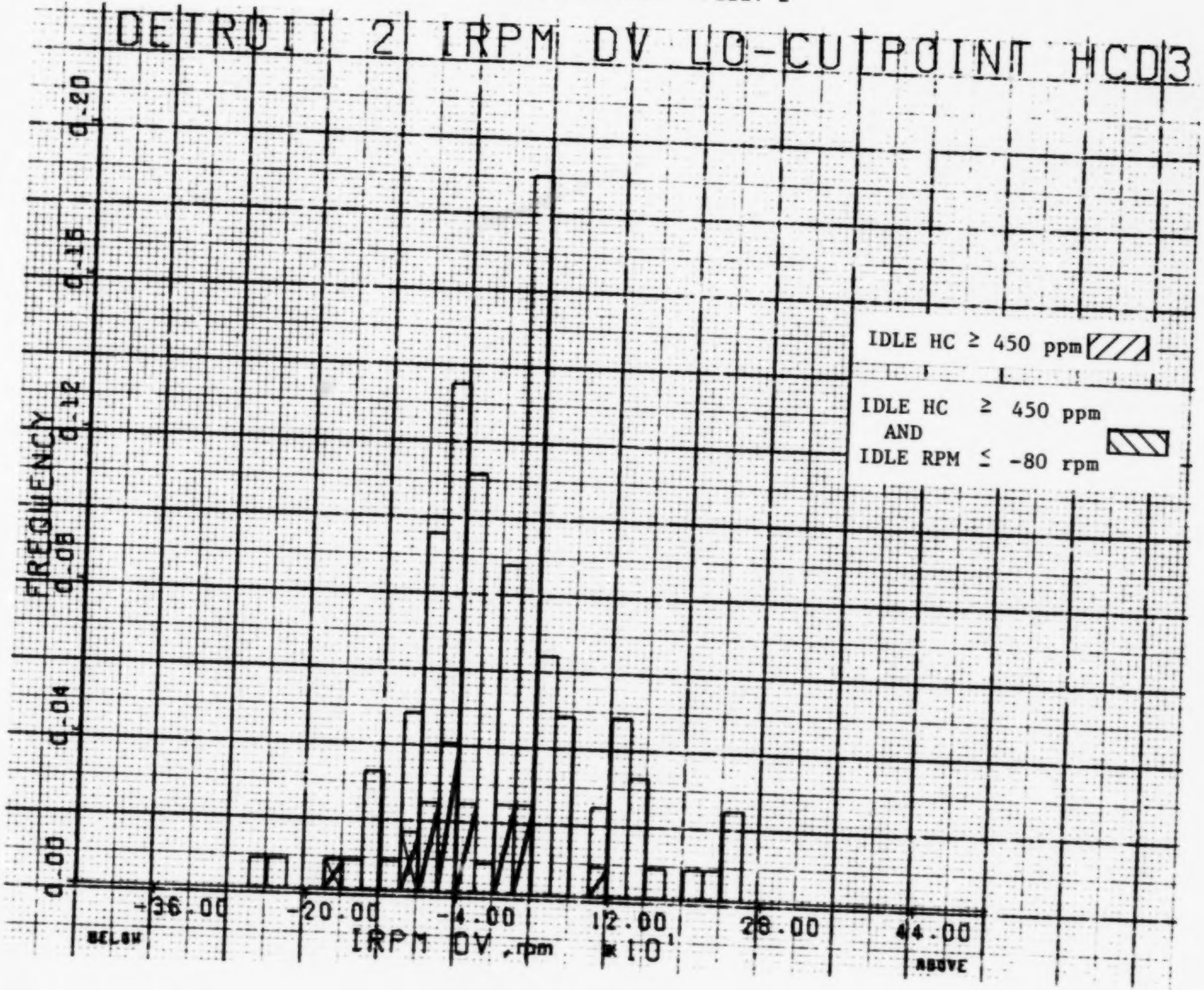


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

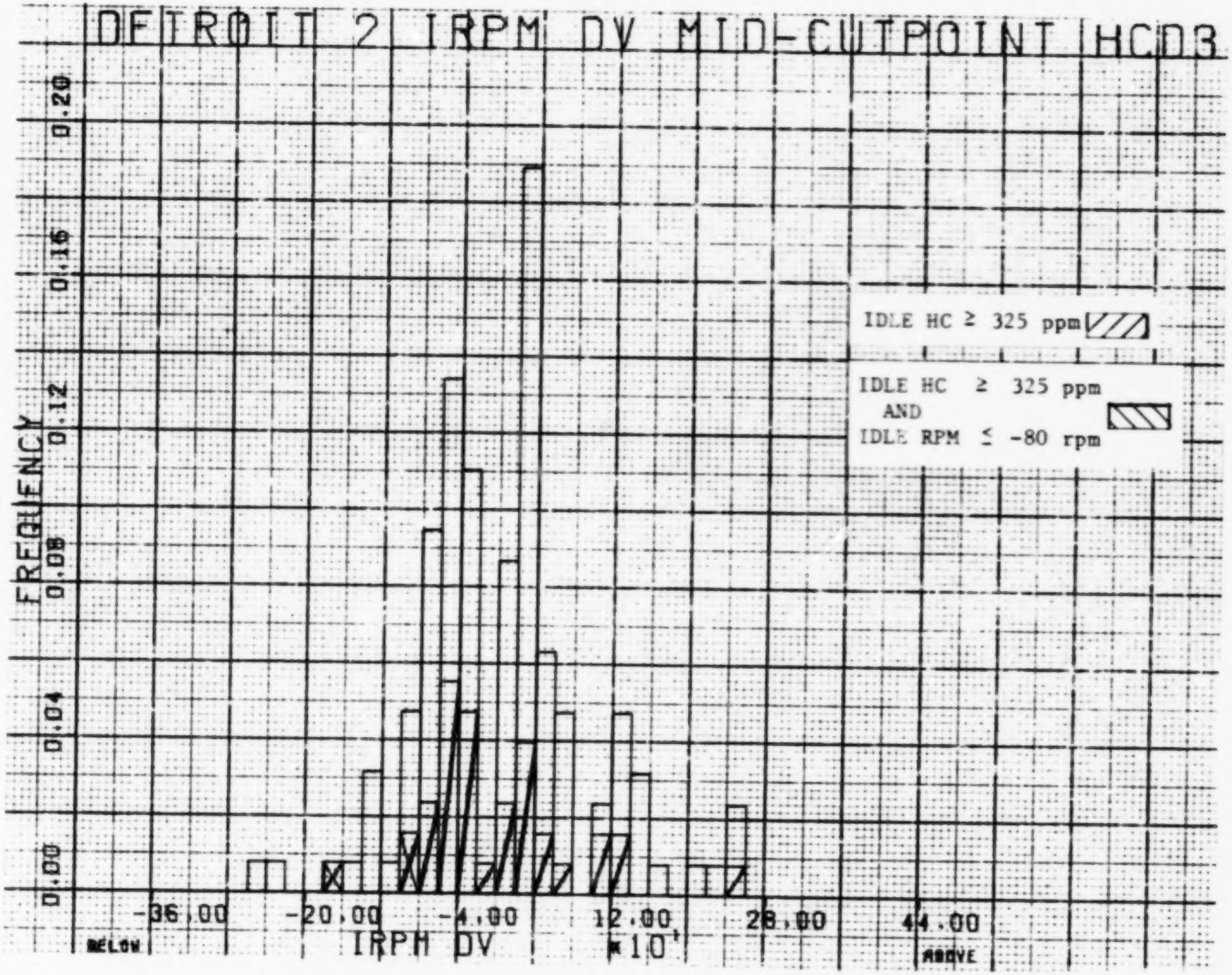


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

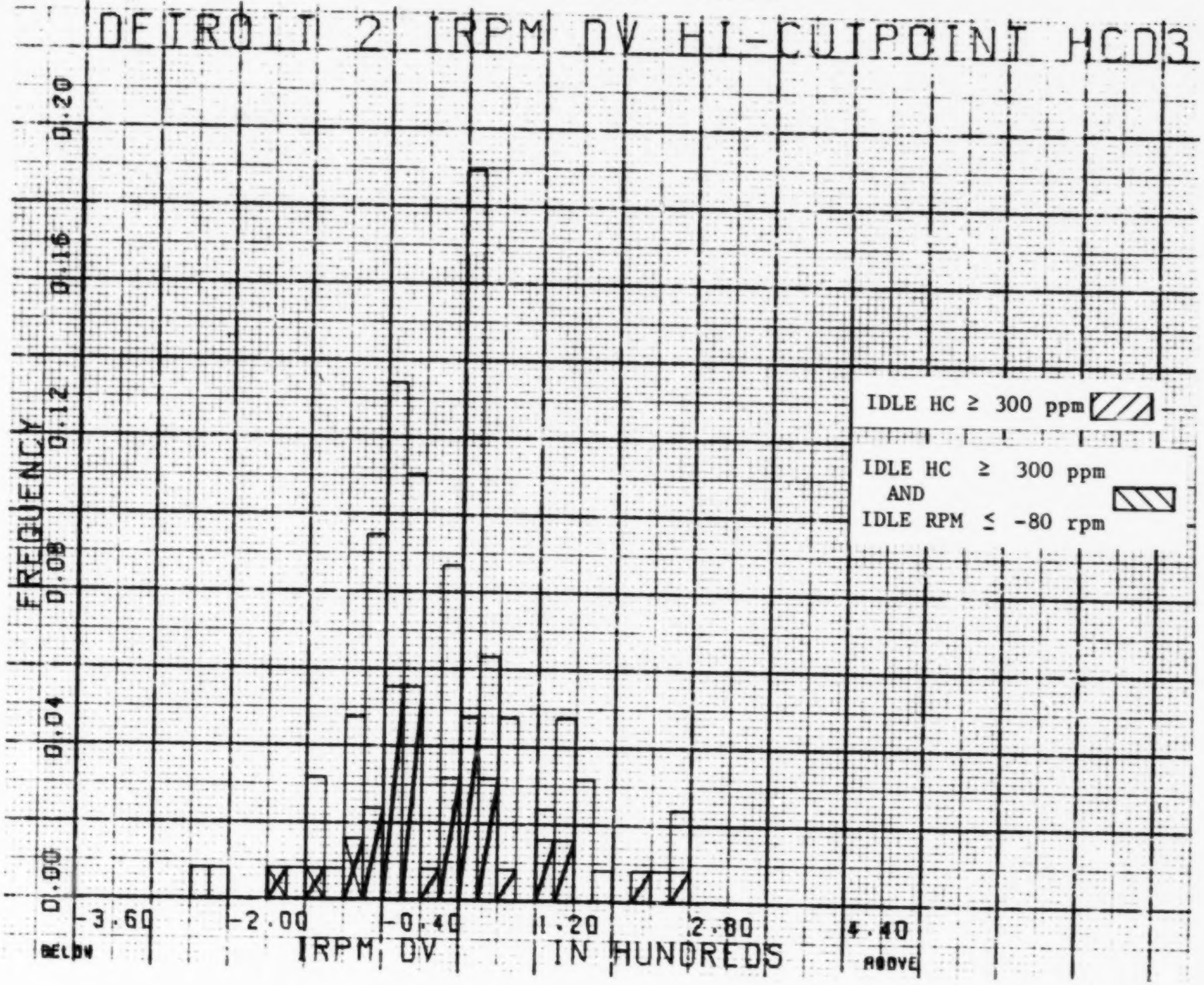


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

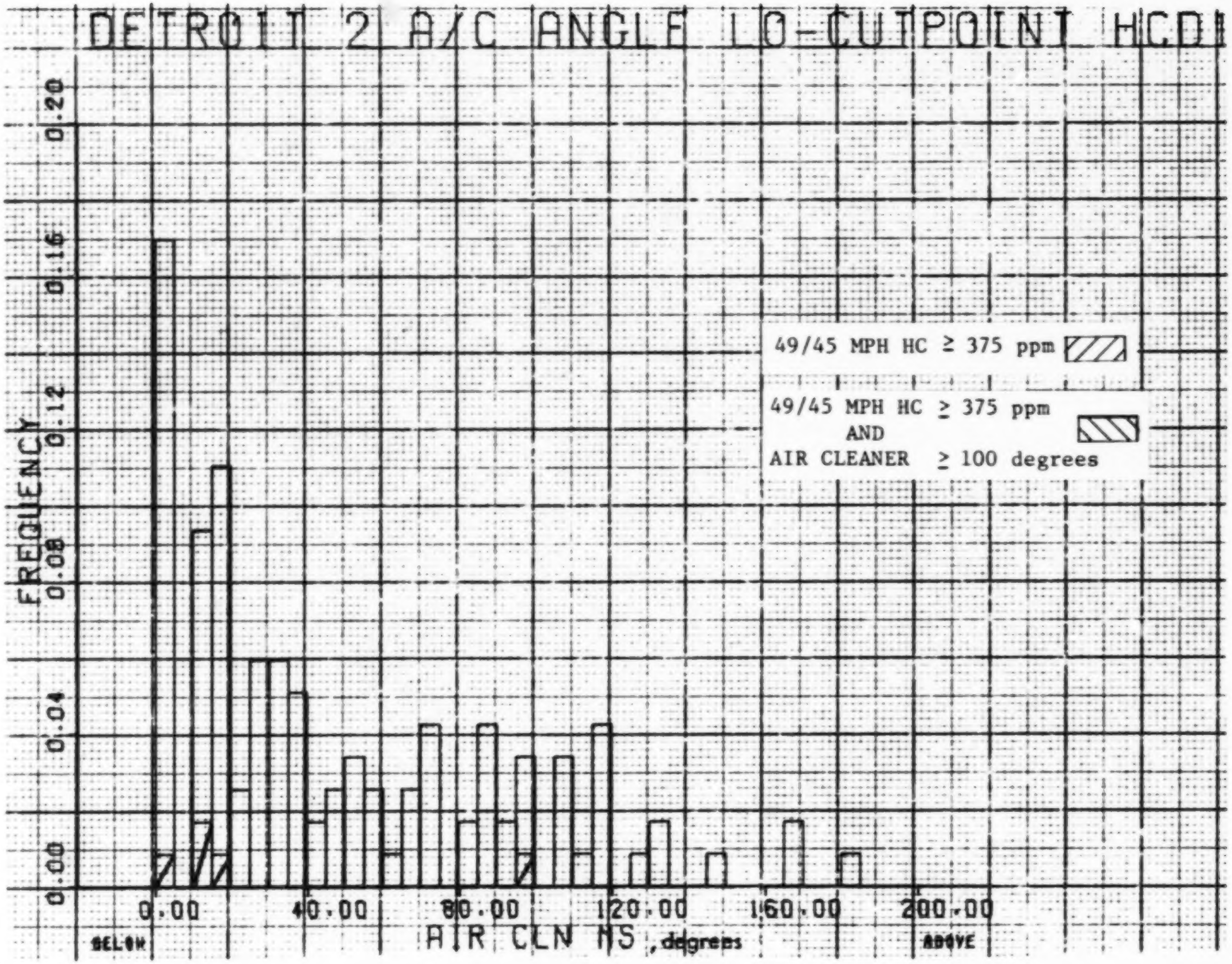


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

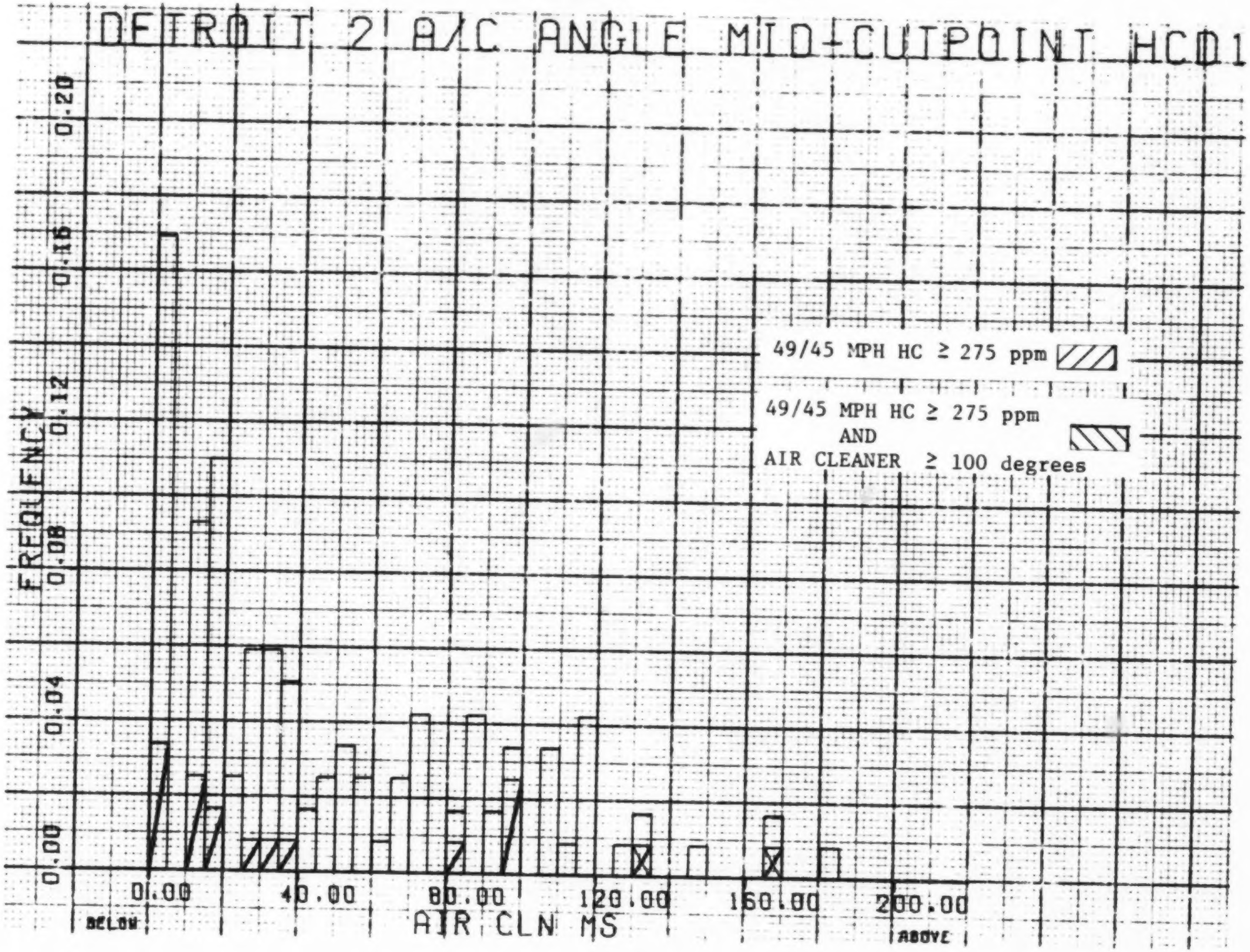


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

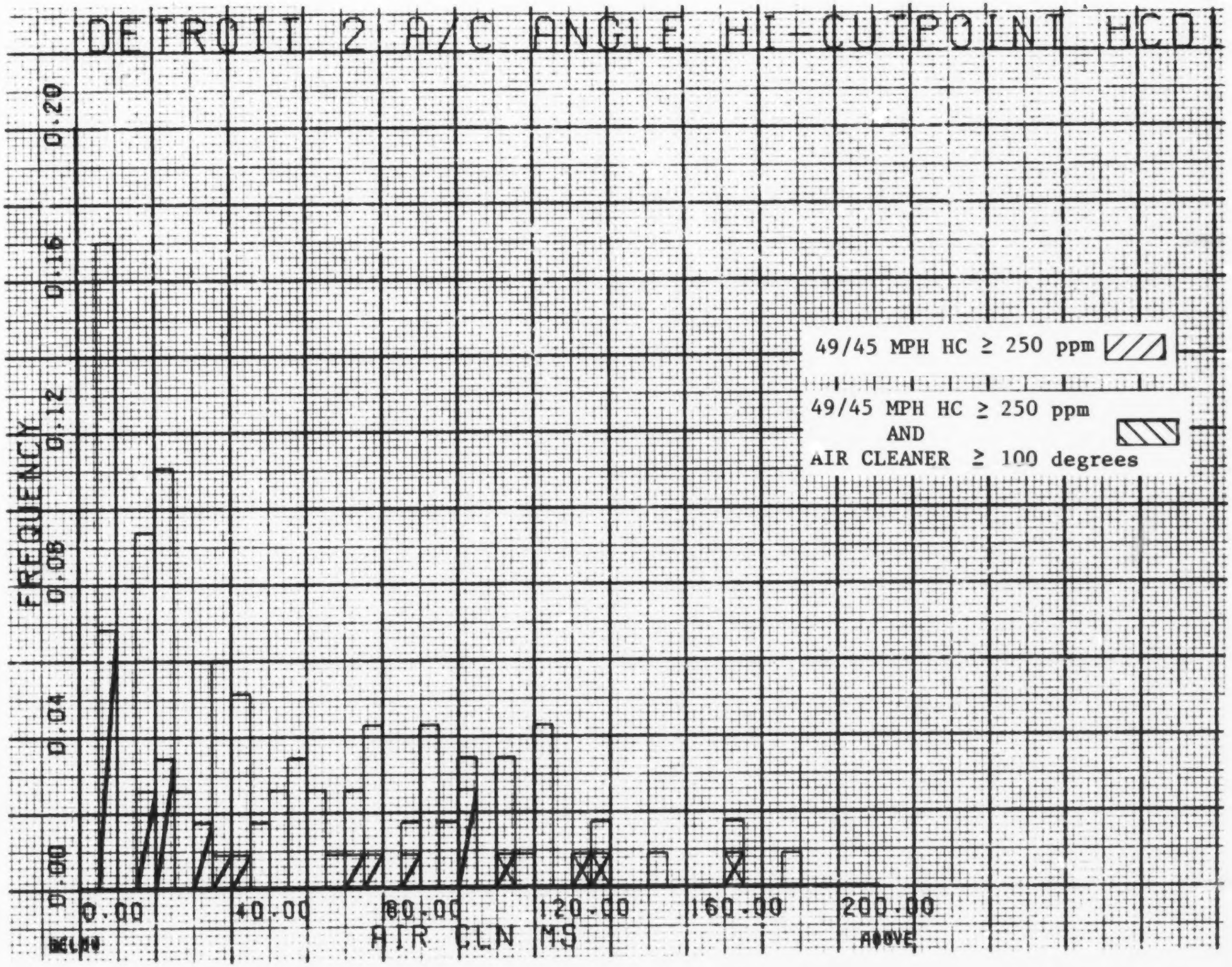


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

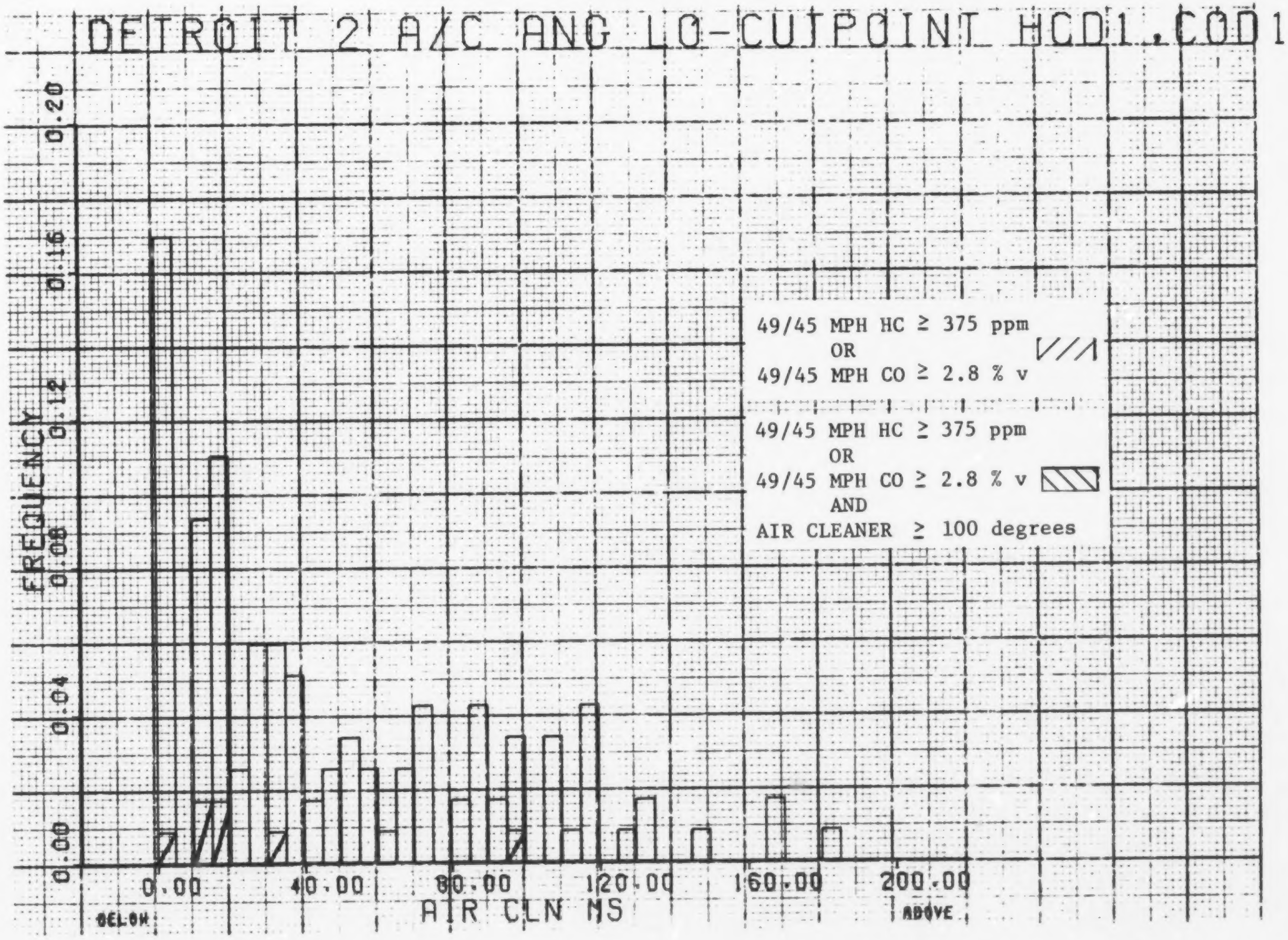


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

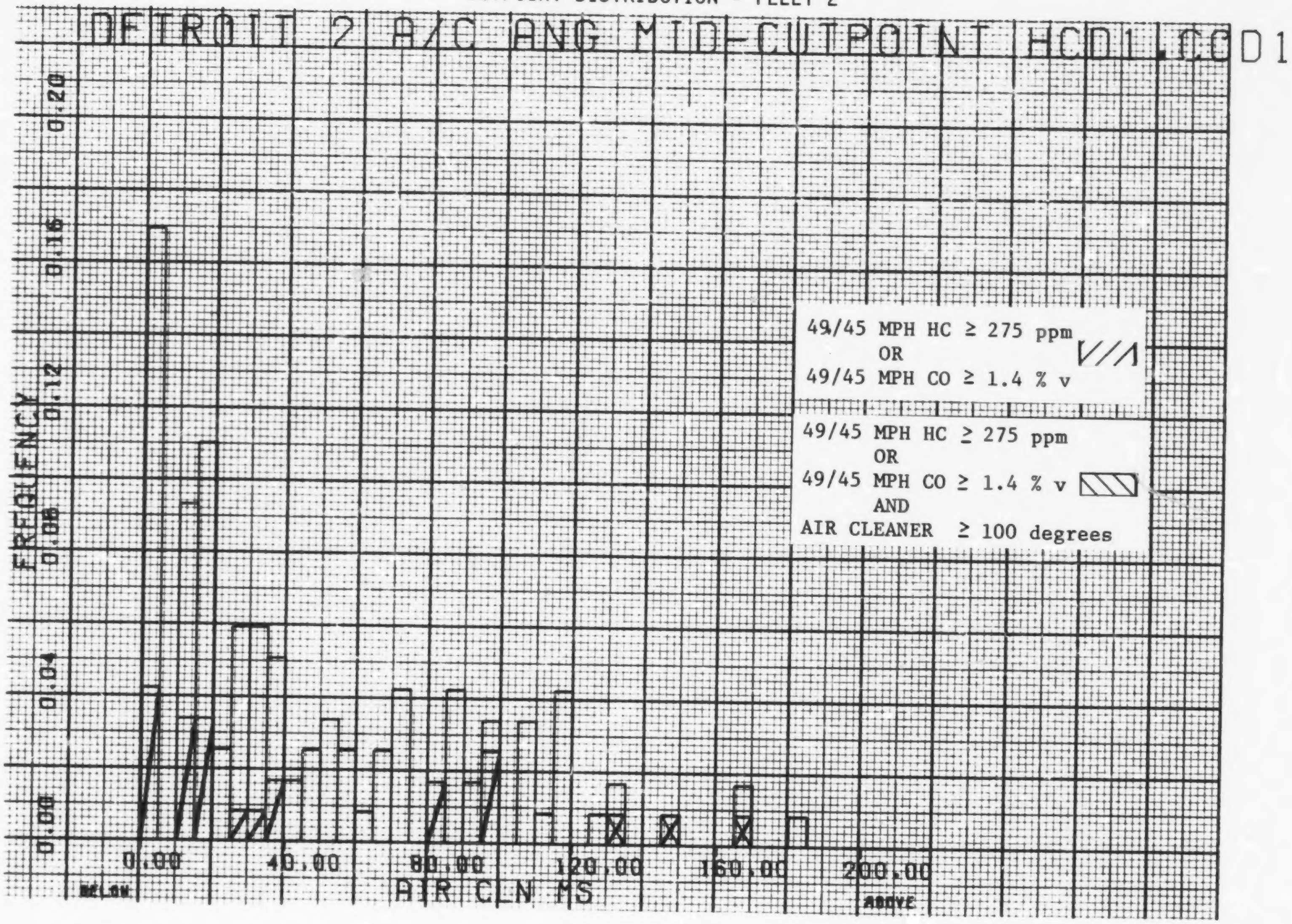


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

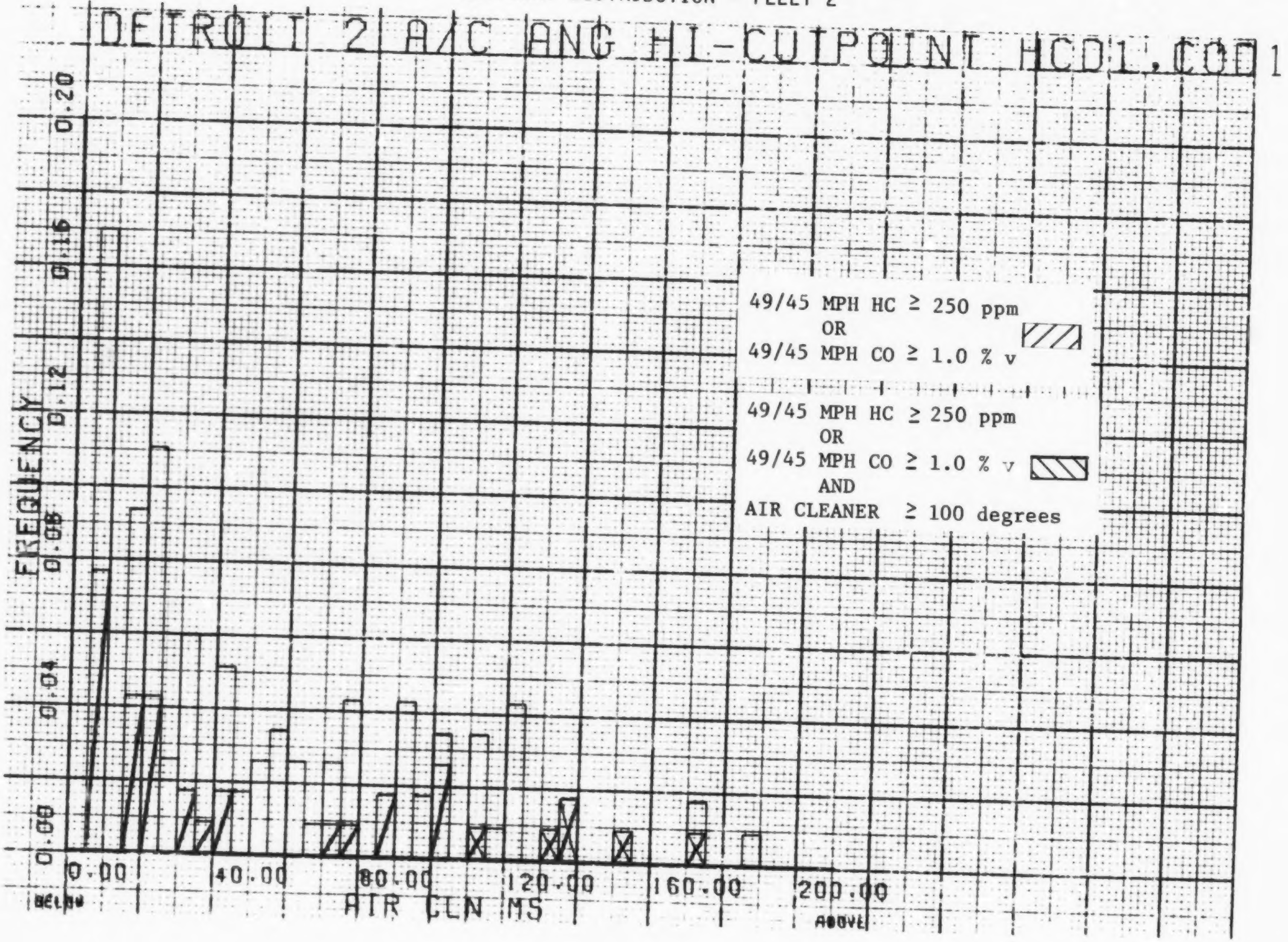


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

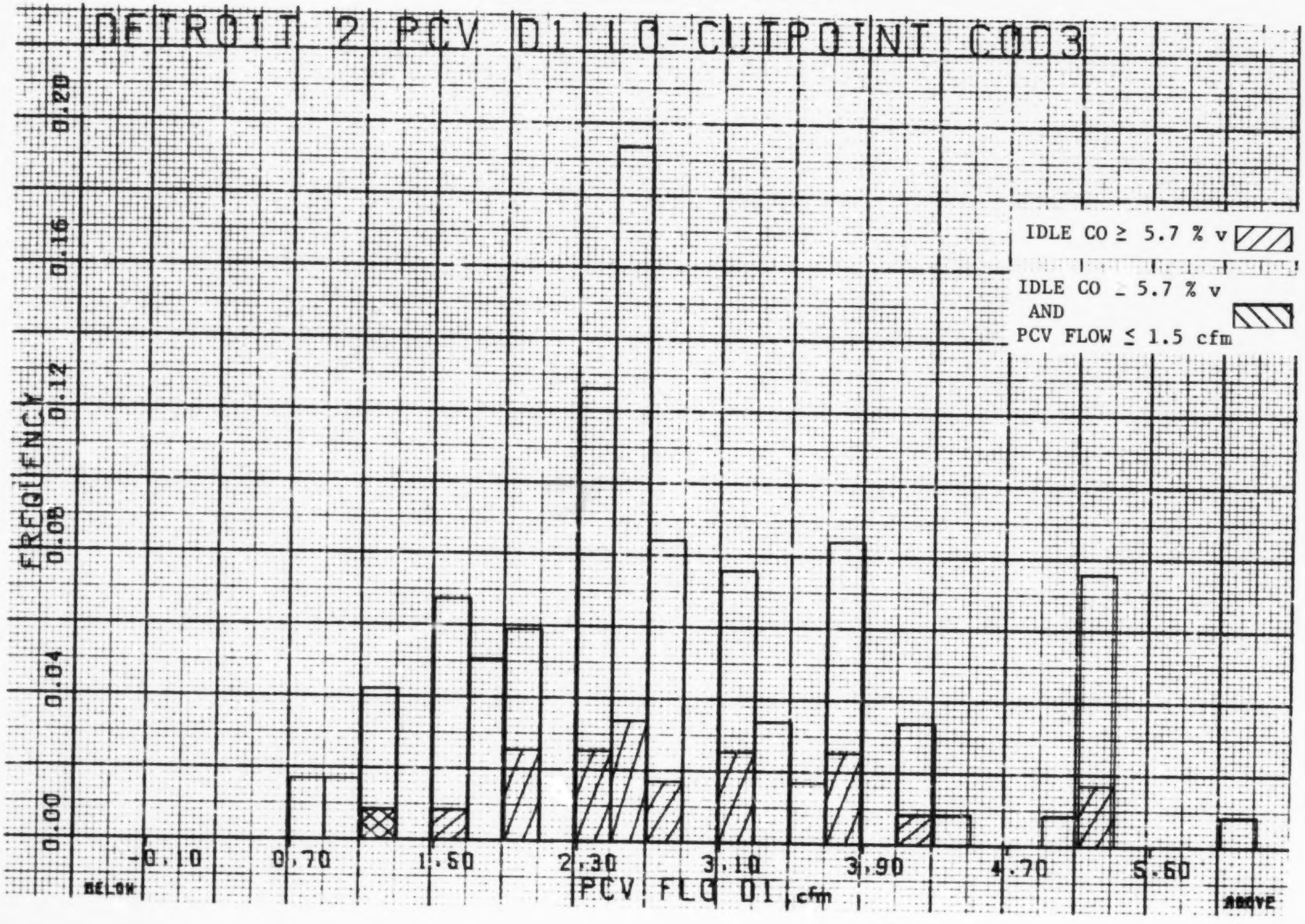


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

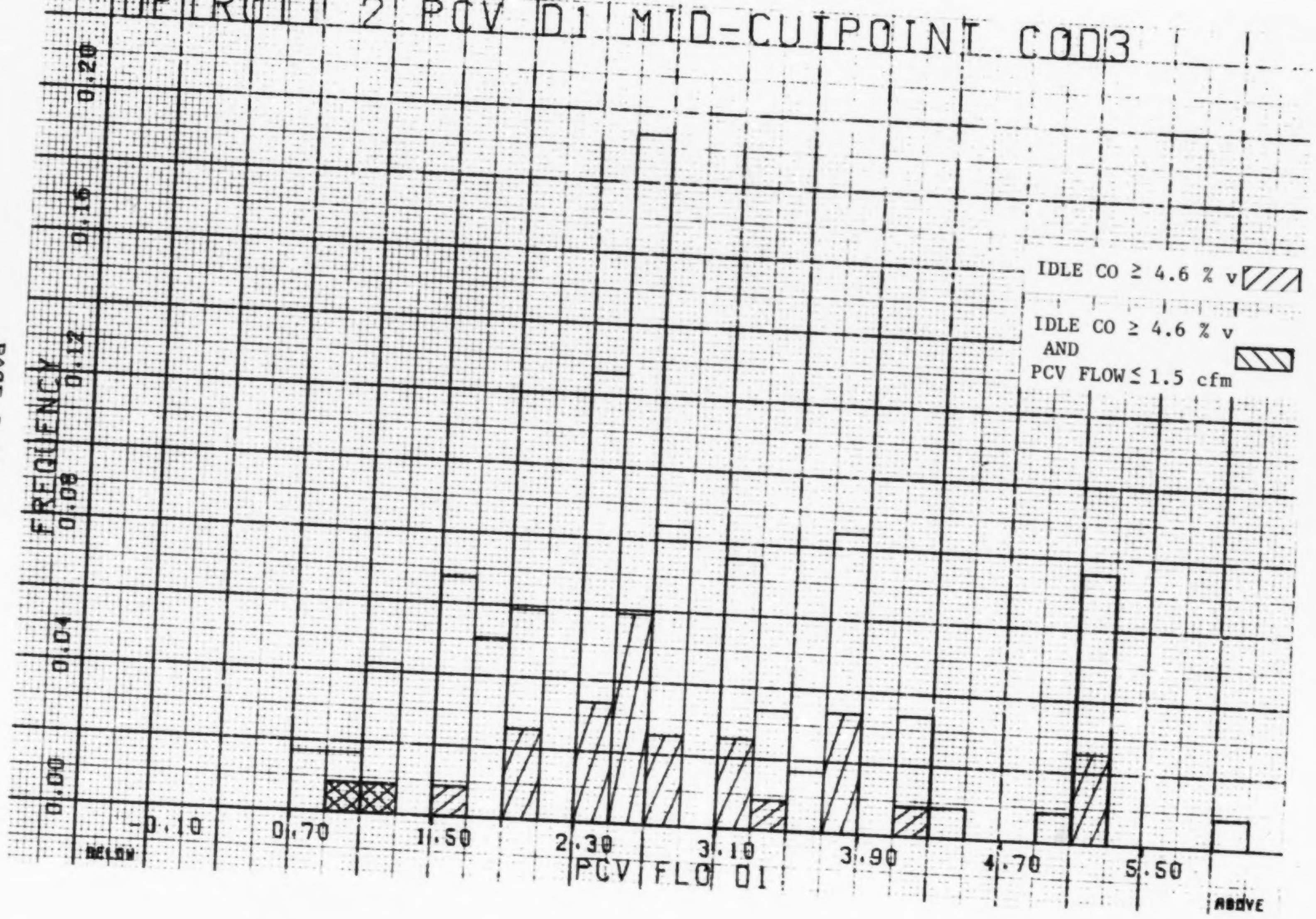


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

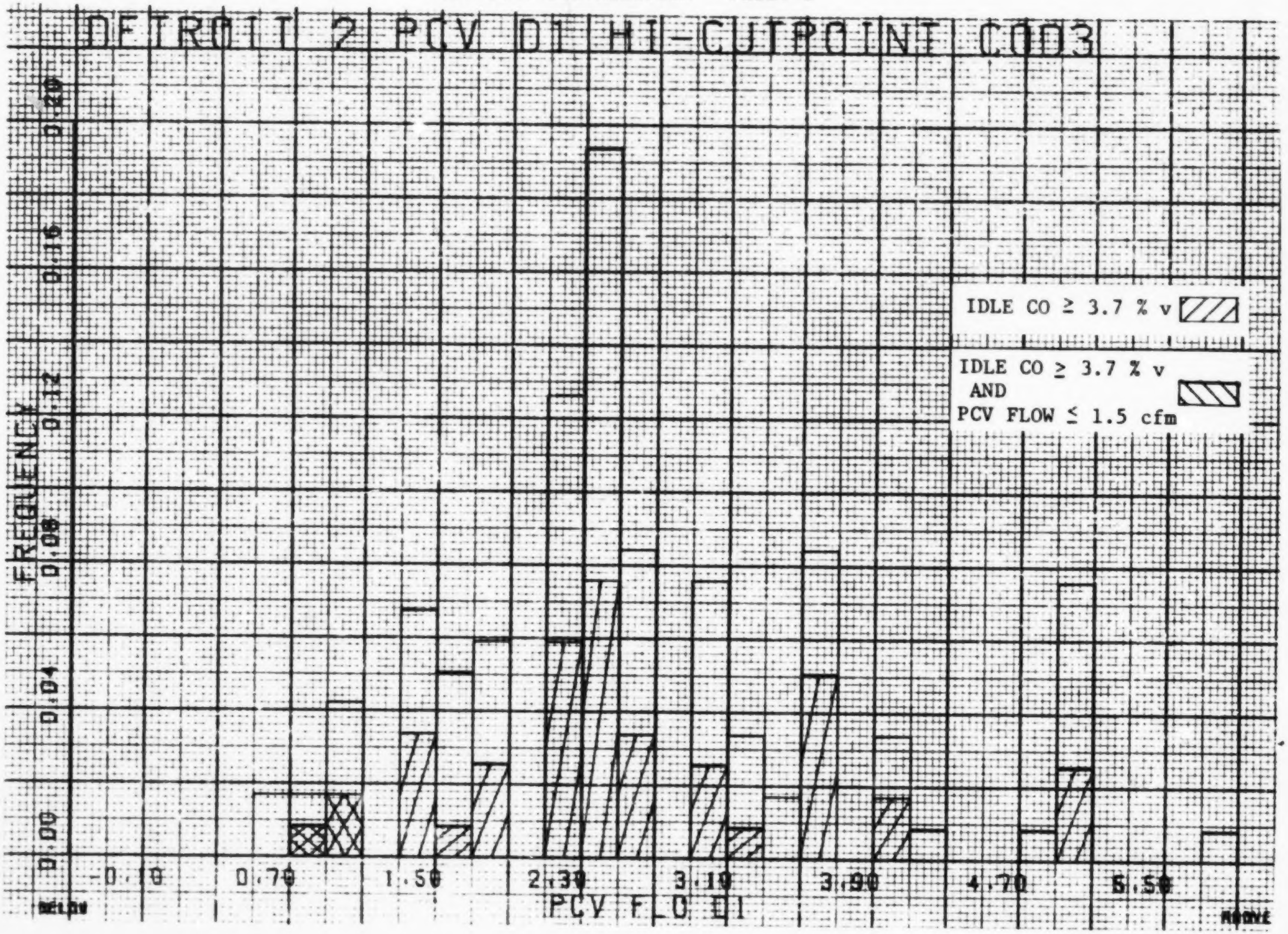


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

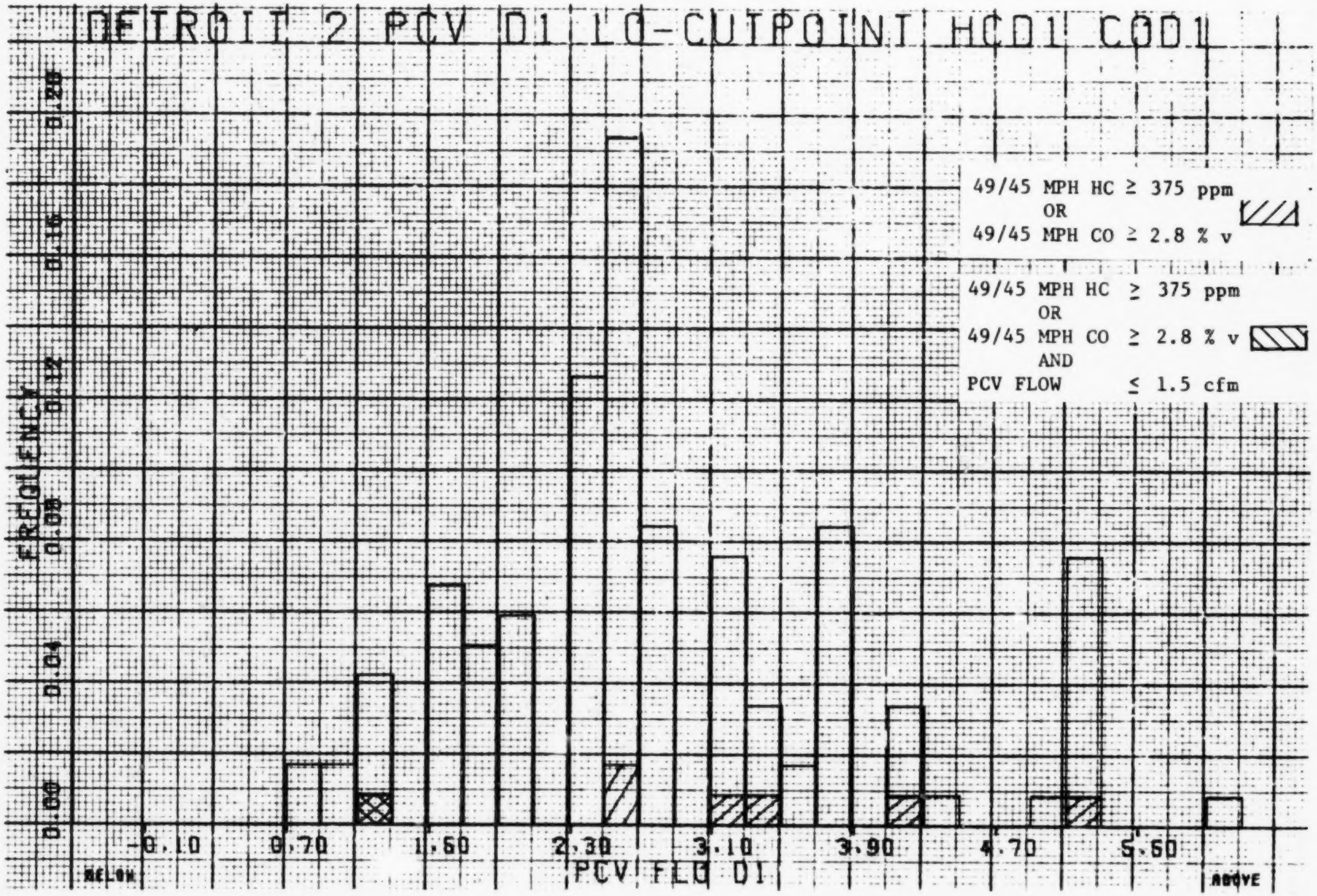


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

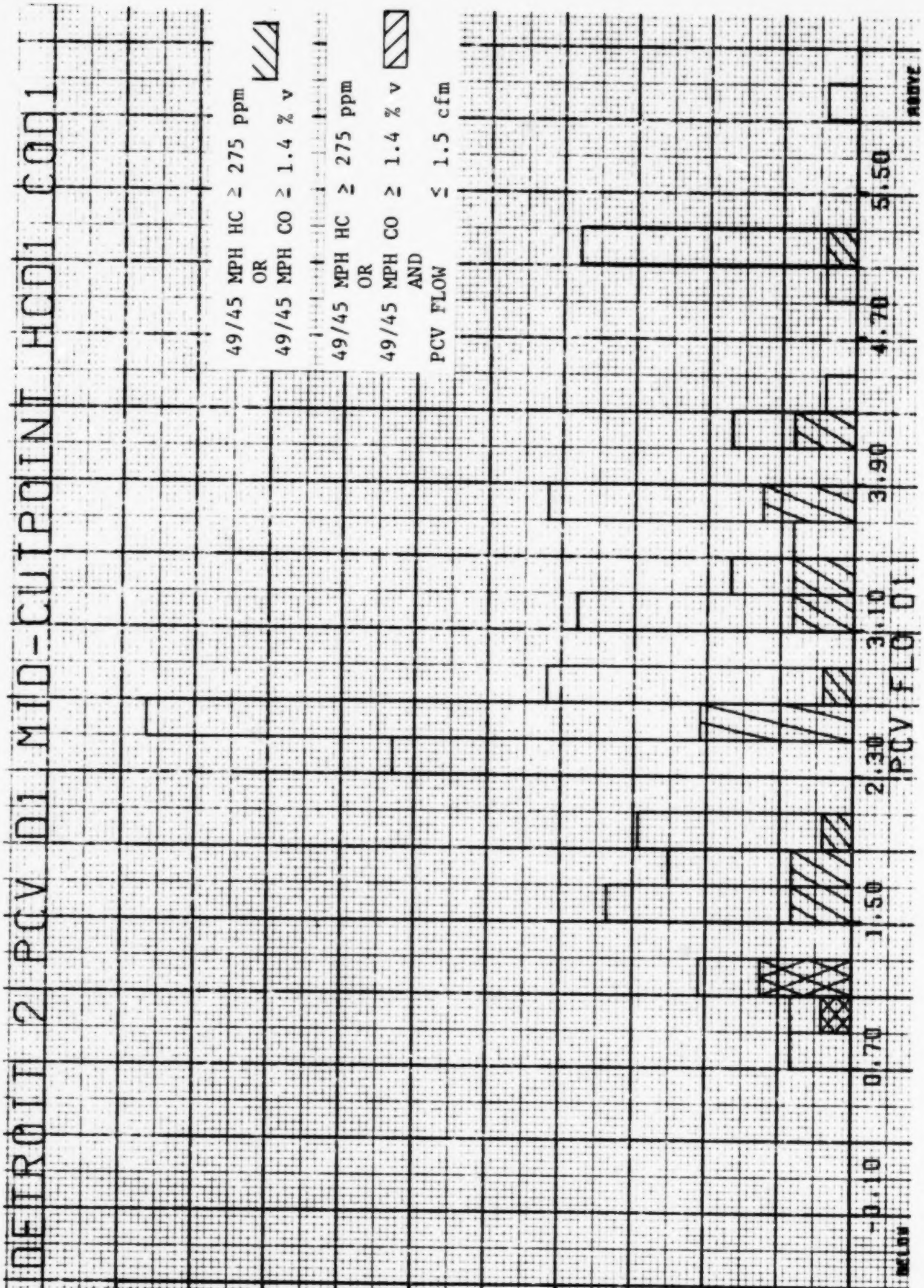


FIGURE 2

CUTPOINT DISTRIBUTION - FLEET 2

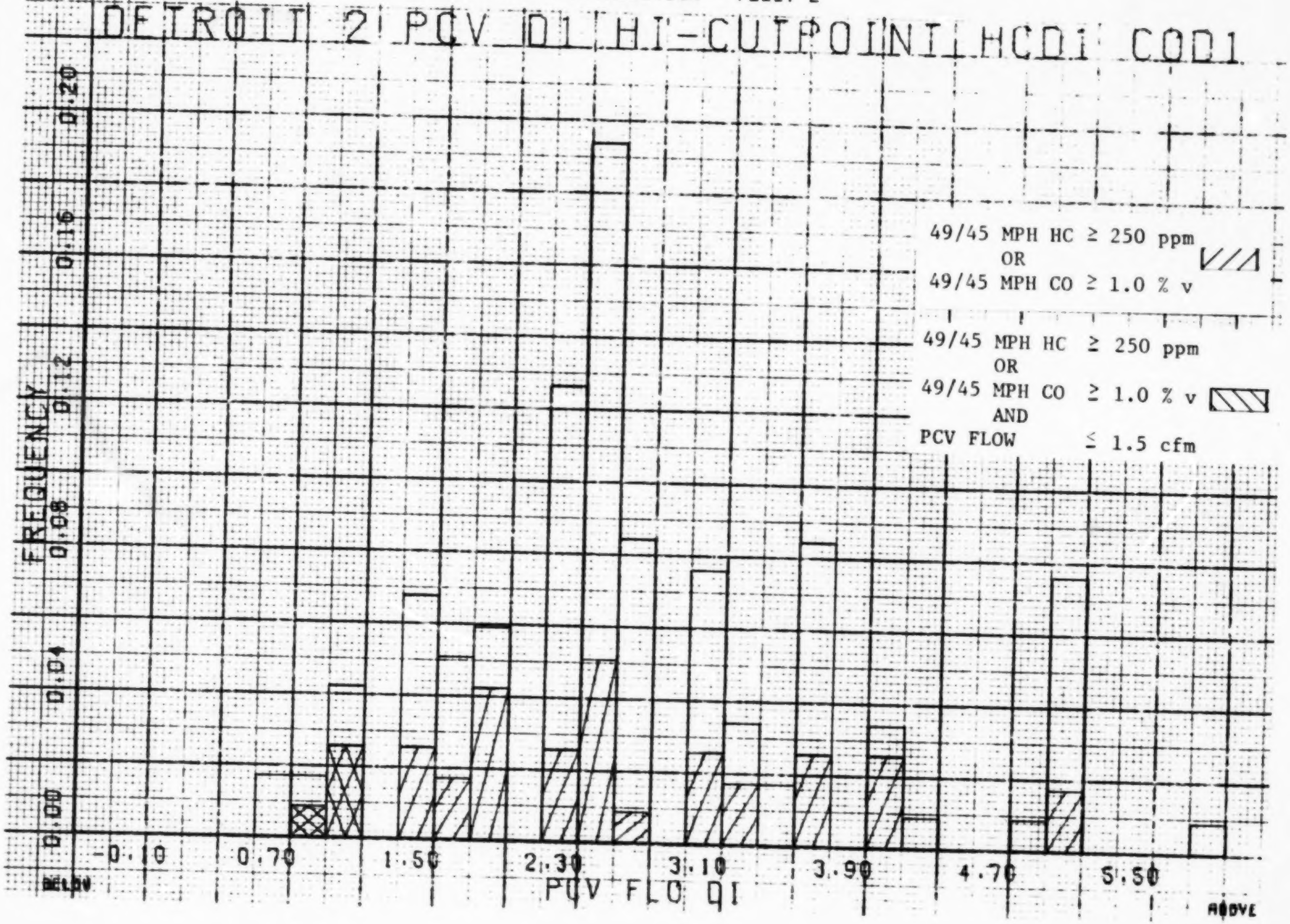


TABLE 1
SUMMARY OF TEST DATA

FLEET 1 DETROIT

TABULATION OF CMC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
1002.0	66.000	3.0000	3935.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	48563	8.0000
1004.0	64.000	3.0000	3745.0	140.00	230.00	6.0000	1.0000	1.0000	0.	1.0000	61282	6.0000
1005.0	65.000	7.0000	4165.0	270.00	383.00	2.0000	2.0000	1.0000	0.	1.0000	51736	8.0000
1010.0	67.000	11.000	4012.0	280.00	343.00	2.0000	4.0000	1.0000	0.	1.0000	53971	8.0000
1012.0	64.000	3.0000	3745.0	155.00	230.00	6.0000	1.0000	0.	0.	1.0000	41728	6.0000
1014.0	66.000	7.0000	4485.0	270.00	383.00	5.0000	2.0000	1.0000	0.	1.0000	51826	8.0000
1015.0	66.000	8.0000	3505.0	145.00	225.00	1.0000	1.0000	1.0000	0.	1.0000	60137	6.0000
1016.0	61.000	6.0000	4160.0	265.00	361.00	5.0000	2.0000	1.0000	0.	-0.	79465	8.0000
1017.0	66.000	8.0000	3250.0	180.00	273.00	2.0000	2.0000	1.0000	0.	1.0000	57768	8.0000
1018.0	64.000	9.0000	4150.0	138.00	223.00	7.0000	1.0000	0.	0.	-0.	52644	6.0000
1022.0	67.000	4.0000	3665.0	320.00	330.00	6.0000	4.0000	1.0000	0.	1.0000	74768	8.0000
1026.0	66.000	3.0000	3970.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	34437	8.0000
1027.0	67.000	3.0000	4010.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	63726	8.0000
1028.0	65.000	9.0000	2870.0	120.00	200.00	7.0000	1.0000	1.0000	0.	-0.	46657	6.0000
1030.0	67.000	3.0000	3870.0	155.00	250.00	6.0000	1.0000	1.0000	0.	1.0000	32925	6.0000
1031.0	67.000	9.0000	4615.0	270.00	390.00	7.0000	2.0000	1.0000	0.	1.0000	54402	8.0000
1033.0	67.000	8.0000	3330.0	180.00	273.00	2.0000	2.0000	1.0000	0.	1.0000	24932	8.0000
1034.0	65.000	1.0000	4541.0	340.00	425.00	6.0000	4.0000	1.0000	0.	1.0000	80763	8.0000
1040.0	65.000	9.0000	4950.0	330.00	390.00	7.0000	4.0000	1.0000	0.	1.0000	52441	8.0000
1043.0	67.000	3.0000	4010.0	210.00	327.00	6.0000	4.0000	1.0000	0.	1.0000	52092	8.0000
1045.0	65.000	3.0000	3495.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	77488	8.0000
1046.0	66.000	9.0000	4018.0	250.00	352.00	7.0000	4.0000	1.0000	0.	1.0000	59212	8.0000
1060.0	66.000	9.0000	4018.0	250.00	352.00	7.0000	4.0000	1.0000	0.	1.0000	55219	8.0000
1063.0	67.000	6.0000	4685.0	270.00	383.00	5.0000	2.0000	1.0000	0.	1.0000	44558	8.0000
1064.0	62.000	9.0000	4139.0	220.00	352.00	7.0000	2.0000	1.0000	0.	-0.	51991	8.0000
1065.0	65.000	5.0000	4273.0	290.00	389.00	6.0000	2.0000	1.0000	0.	1.0000	52225	8.0000
1067.0	66.000	9.0000	4018.0	315.00	390.00	1.0000	4.0000	1.0000	0.	1.0000	47118	8.0000
1068.0	65.000	3.0000	3810.0	120.00	194.00	6.0000	1.0000	1.0000	0.	1.0000	39655	6.0000
1073.0	64.000	3.0000	2745.0	95.000	164.00	6.0000	1.0000	0.	0.	1.0000	66537	4.0000
1075.0	65.000	1.0000	3435.0	155.00	225.00	6.0000	1.0000	1.0000	0.	1.0000	35631	6.0000
1077.0	63.000	7.0000	3580.0	145.00	225.00	5.0000	1.0000	1.0000	0.	1.0000	57276	6.0000
1079.0	65.000	9.0000	3841.0	250.00	352.00	7.0000	4.0000	1.0000	0.	1.0000	49270	8.0000
1085.0	65.000	6.0000	4578.0	325.00	383.00	2.0000	4.0000	1.0000	0.	1.0000	44186	8.0000
1087.0	66.000	9.0000	4018.0	200.00	289.00	7.0000	2.0000	1.0000	0.	1.0000	61439	8.0000
1090.0	66.000	8.0000	3365.0	145.00	225.00	1.0000	1.0000	1.0000	0.	1.0000	64499	6.0000
1094.0	62.000	11.000	3055.0	127.00	196.00	2.0000	1.0000	1.0000	0.	-0.	28174	6.0000
1095.0	66.000	9.0000	2906.0	120.00	200.00	7.0000	1.0000	1.0000	0.	1.0000	42735	6.0000
1096.0	67.000	9.0000	2828.0	120.00	200.00	2.0000	1.0000	1.0000	0.	1.0000	33616	6.0000
1098.0	65.000	3.0000	3975.0	250.00	327.00	6.0000	4.0000	1.0000	0.	1.0000	40735	8.0000
1099.0	66.000	6.0000	4485.0	270.00	383.00	2.0000	2.0000	1.0000	0.	1.0000	55242	8.0000
1101.0	65.000	1.0000	4247.0	210.00	300.00	6.0000	2.0000	1.0000	0.	1.0000	56522	8.0000
1102.0	65.000	4.0000	4394.0	345.00	400.00	6.0000	4.0000	1.0000	0.	4.0000	45703	8.0000
1104.0	66.000	9.0000	2906.0	120.00	200.00	3.0000	1.0000	0.	0.	1.0000	42303	6.0000
1107.0	63.000	11.000	3829.0	270.00	327.00	1.0000	4.0000	1.0000	0.	0.	76735	8.0000
1108.0	63.000	9.0000	2803.0	101.00	170.00	3.0000	1.0000	1.0000	0.	0.	57511	6.0000
1110.0	66.000	11.000	3140.0	155.00	232.00	2.0000	2.0000	1.0000	0.	1.0000	63429	6.0000
1111.0	64.000	9.0000	4435.0	250.00	352.00	3.0000	4.0000	1.0000	0.	0.	98740	8.0000
1112.0	64.000	12.000	1931.0	40.000	73.000	4.0000	1.0000	0.	0.	3.0000	98896	4.0000
1114.0	64.000	3.0000	3745.0	140.00	230.00	6.0000	1.0000	1.0000	0.	1.0000	33369	6.0000
1115.0	67.000	5.0000	4324.0	255.00	400.00	6.0000	2.0000	1.0000	0.	4.0000	48274	8.0000
1116.0	65.000	9.0000	2920.0	200.00	289.00	3.0000	2.0000	1.0000	0.	0.	23515	8.0000
1124.0	65.000	3.0000	3975.0	250.00	327.00	6.0000	4.0000	1.0000	0.	1.0000	42997	8.0000
1125.0	65.000	8.0000	3660.0	230.00	318.00	2.0000	2.0000	1.0000	0.	1.0000	87537	8.0000
1126.0	66.000	7.0000	3571.0	230.00	318.00	5.0000	2.0000	1.0000	0.	1.0000	79793	8.0000
1128.0	65.000	3.0000	3975.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	36368	6.0000
1133.0	64.000	5.0000	4263.0	235.00	389.00	6.0000	2.0000	1.0000	0.	1.0000	40812	8.0000
1134.0	65.000	12.000	1931.0	40.000	72.750	4.0000	1.0000	0.	0.	3.0000	70481	4.0000
1135.0	65.000	3.0000	3810.0	120.00	194.00	6.0000	1.0000	1.0000	0.	1.0000	32876	6.0000
1136.0	66.000	9.0000	3151.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	37140	8.0000
1137.0	66.000	12.000	1931.0	50.000	78.300	4.0000	1.0000	0.	0.	3.0000	92303	4.0000
1138.0	65.000	9.0000	3841.0	200.00	289.00	3.0000	2.0000	1.0000	0.	0.	63150	8.0000
1140.0	66.000	4.0000	3669.0	155.00	250.00	6.0000	1.0000	0.	0.	1.0000	30082	6.0000
1142.0	66.000	1.0000	4327.0	325.00	400.00	6.0000	4.0000	1.0000	0.	1.0000	40122	8.0000
1143.0	65.000	2.0000	5056.0	340.00	429.00	6.0000	4.0000	1.0000	0.	1.0000	61076	8.0000
1144.0	67.000	2.0000	5028.0	340.00	[illegible]	6.0000	4.0000	1.0000	0.	1.0000	40826	8.0000
1145.0	62.000	3.0000	3836.0	170.00	283.00	6.0000	2.0000	1.0000	0.	0.	37615	8.0000

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

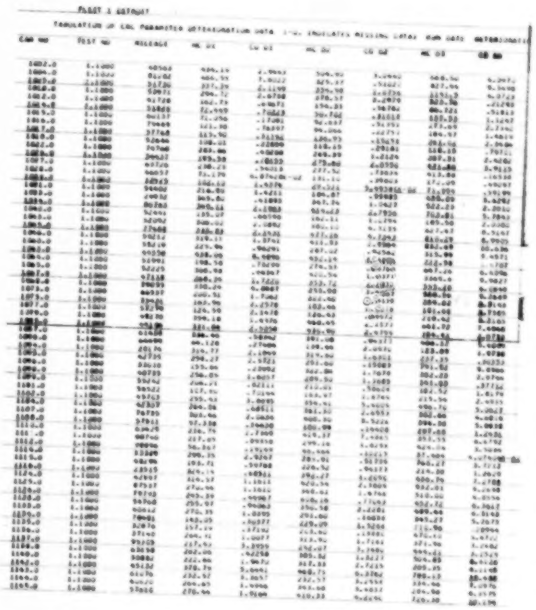
CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
1146.0	63.000	12.000	2064.0	53.000	91.000	4.0000	1.0000	0.	0.	3.0000	66924	4.0000
1147.0	63.000	5.0000	4263.0	235.00	389.00	6.0000	2.0000	1.0000	0.	1.0000	88272	8.0000
1149.0	67.000	3.0000	4010.0	275.00	327.00	6.0000	4.0000	1.0000	0.	1.0000	66351	8.0000
1150.0	66.000	2.0000	5056.0	340.00	429.00	6.0000	4.0000	1.0000	0.	1.0000	82236	8.0000
1152.0	67.000	8.0000	4100.0	230.00	318.00	2.0000	2.0000	1.0000	0.	1.0000	40441	8.0000
1155.0	63.000	8.0000	3551.0	230.00	318.00	5.0000	2.0000	1.0000	0.	1.0000	46028	8.0000
1156.0	65.000	9.0000	3151.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	31203	8.0000
1157.0	62.000	3.0000	3745.0	135.00	235.50	6.0000	1.0000	1.0000	0.	0.	95646	6.0000
1158.0	66.000	12.000	2108.0	50.000	78.300	4.0000	1.0000	0.	0.	3.0000	47986	4.0000
1159.0	65.000	7.0000	2935.0	101.00	170.00	1.0000	1.0000	1.0000	0.	1.0000	66657	6.0000
1162.0	67.000	9.0000	3193.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	48273	8.0000
1164.0	64.000	9.0000	4150.0	250.00	352.00	3.0000	4.0000	1.0000	0.	1.0000	63334	8.0000
1165.0	67.000	8.0000	3310.0	180.00	273.00	2.0000	2.0000	1.0000	0.	1.0000	38917	8.0000
1166.0	67.000	5.0000	4324.0	290.00	400.00	6.0000	2.0000	1.0000	0.	1.0000	46676	8.0000
1167.0	63.000	3.0000	3737.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	35423	8.0000
1170.0	66.000	5.0000	4573.0	325.00	389.00	6.0000	4.0000	1.0000	0.	1.0000	42755	8.0000
1173.0	67.000	9.0000	4000.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	45808	8.0000
1179.0	63.000	3.0000	3890.0	195.00	283.00	6.0000	2.0000	1.0000	0.	0.	52955	8.0000
1180.0	61.000	3.0000	2855.0	80.000	145.00	6.0000	1.0000	1.0000	0.	0.	49775	4.0000
1184.0	67.000	5.0000	3777.0	250.00	326.00	6.0000	2.0000	1.0000	0.	1.0000	36567	8.0000
1187.0	66.000	3.0000	4010.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	58368	8.0000
1189.0	65.000	5.0000	3650.0	250.00	326.00	6.0000	2.0000	0.	0.	1.0000	84385	8.0000
1190.0	64.000	4.0000	4703.0	330.00	394.00	6.0000	4.0000	1.0000	0.	0.	70241	8.0000
1200.0	62.000	7.0000	2942.0	145.00	225.00	2.0000	1.0000	1.0000	0.	0.	62147	6.0000
1204.0	67.000	3.0000	3210.0	140.00	230.00	6.0000	1.0000	1.0000	0.	1.0000	80490	6.0000
1206.0	61.000	4.0000	4324.0	250.00	394.00	6.0000	2.0000	1.0000	0.	0.	90163	8.0000
1208.0	65.000	10.000	4310.0	250.00	390.00	3.0000	2.0000	1.0000	0.	0.	43138	8.0000
1209.0	67.000	9.0000	3193.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	58822	8.0000
1210.0	61.000	10.000	3153.0	85.000	144.00	1.0000	1.0000	1.0000	0.	0.	53118	6.0000
1213.0	60.000	10.000	4390.0	265.00	390.00	3.0000	2.0000	1.0000	0.	1.0000	38796	8.0000
1214.0	67.000	3.0000	3210.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	75105	8.0000
1216.0	65.000	10.000	4310.0	265.00	390.00	3.0000	2.0000	1.0000	0.	1.0000	63188	8.0000
1218.0	66.000	4.0000	4669.0	300.00	425.00	6.0000	4.0000	1.0000	0.	1.0000	52627	8.0000
1219.0	63.000	3.0000	2855.0	80.000	145.00	6.0000	1.0000	1.0000	0.	1.0000	46253	6.0000
1220.0	65.000	3.0000	2795.0	110.00	164.00	6.0000	1.0000	1.0000	0.	1.0000	81432	6.0000
1223.0	65.000	4.0000	4394.0	250.00	330.00	6.0000	2.0000	1.0000	0.	1.0000	1.06535E+05	8.0000
1226.0	63.000	3.0000	3737.0	140.00	230.00	6.0000	1.0000	0.	0.	1.0000	1.01221E+05	6.0000
1227.0	66.000	5.0000	3729.0	250.00	326.00	6.0000	2.0000	1.0000	0.	1.0000	81452	8.0000
1228.0	64.000	3.0000	3890.0	195.00	283.00	6.0000	2.0000	1.0000	0.	0.	38608	8.0000
1230.0	65.000	1.0000	4541.0	340.00	425.00	6.0000	4.0000	1.0000	0.	1.0000	1.07424E+05	8.0000
1233.0	67.000	7.0000	3145.0	145.00	225.00	1.0000	1.0000	1.0000	0.	1.0000	42130	6.0000
1234.0	65.000	9.0000	2920.0	225.00	289.00	3.0000	4.0000	1.0000	0.	0.	53266	8.0000
1235.0	65.000	10.000	3153.0	116.00	200.00	3.0000	1.0000	1.0000	0.	0.	23071	6.0000
1236.0	67.000	3.0000	3070.0	140.00	230.00	6.0000	1.0000	0.	0.	1.0000	56672	6.0000
1238.0	67.000	4.0000	3665.0	250.00	330.00	6.0000	2.0000	0.	0.	1.0000	57718	8.0000
1239.0	62.000	9.0000	4153.0	220.00	352.00	3.0000	2.0000	1.0000	0.	0.	49666	8.0000
1240.0	66.000	4.0000	4265.0	320.00	330.00	6.0000	4.0000	1.0000	0.	1.0000	69716	8.0000
1241.0	64.000	9.0000	2803.0	101.00	170.00	3.0000	1.0000	1.0000	0.	1.0000	63593	6.0000
1242.0	63.000	9.0000	2803.0	101.00	170.00	3.0000	1.0000	1.0000	0.	0.	63877	6.0000
1243.0	66.000	3.0000	3045.0	120.00	194.00	6.0000	1.0000	1.0000	0.	1.0000	63423	6.0000
1244.0	67.000	1.0000	4300.0	220.00	340.00	6.0000	2.0000	1.0000	0.	1.0000	44878	8.0000
1245.0	62.000	2.0000	4500.0	325.00	390.00	6.0000	4.0000	1.0000	0.	0.	79466	8.0000
1246.0	64.000	9.0000	3466.0	164.00	260.00	3.0000	2.0000	1.0000	0.	1.0000	55238	8.0000
1247.0	61.000	9.0000	3991.0	175.00	292.00	3.0000	2.0000	1.0000	0.	0.	1.00462E+05	8.0000
1248.0	67.000	1.0000	4704.0	360.00	430.00	6.0000	4.0000	1.0000	0.	1.0000	50516	8.0000
1249.0	62.000	1.0000	4450.0	280.00	401.00	6.0000	2.0000	1.0000	0.	0.	96643	8.0000
1250.0	65.000	7.0000	3115.0	185.00	273.00	2.0000	2.0000	1.0000	0.	1.0000	74692	8.0000
1252.0	62.000	3.0000	2745.0	84.000	145.00	6.0000	1.0000	1.0000	0.	1.0000	35214	6.0000
1253.0	62.000	8.0000	2995.0	101.00	170.00	2.0000	1.0000	1.0000	0.	-0.	84982	6.0000
1255.0	64.000	5.0000	3627.0	250.00	326.00	7.0000	2.0000	0.	0.	1.0000	58663	8.0000
1256.0	64.000	4.0000	3237.0	155.00	225.00	6.0000	1.0000	1.0000	0.	1.0000	60135	6.0000
1258.0	65.000	5.0000	3750.0	250.00	340.00	6.0000	2.0000	1.0000	0.	1.0000	45238	8.0000
1259.0	66.000	3.0000	3070.0	195.00	283.00	6.0000	2.0000	1.0000	0.	1.0000	49975	8.0000
1260.0	66.000	9.0000	4018.0	200.00	289.00	3.0000	2.0000	1.0000	0.	1.0000	65428	8.0000

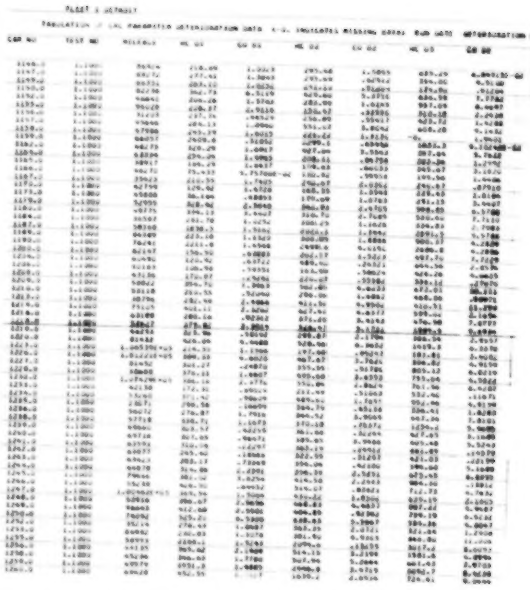
FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
ESTIMATE OF MEAN			3718.8	204.32	289.62	4.7231	2.1231	.88462	0.	.95161	58286	7.2462
ESTIMATE OF STANDARD DEVIATION			674.85	77.499	87.327	1.8927	1.0998	.32072	0.	.69674	19377	1.1751
DEGREES OF FREEDOM			129	129	129	129	129	129	129	123	129	129
T VALUE			62.829	30.060	37.814	29.224	22.010	31.448	-0.	15.209	34.292	70.309

TABLE 1
SUMMARY OF TEST DATA





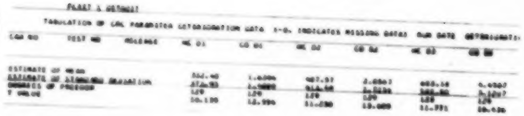


TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	IG TIMG MS	IG TIMG DV	PT DWEL MS	PT DWEL DV	SPARK LINE	MISFIRE D1	MISFIRE D2	MISFIRE D3	RQ VOLT MS/ COIL AV MS	RQ VOLT D1/ COIL AV MS	RQ VOLT D2/ COIL AV MS	RQ VOLT D3/ COIL AV MS
1002.0	1.1000	9.0000	2.5000	-1.5000	32.000	0.	0.	0.	0.	0.	.18382	.20588	.17647	.25000
1004.0	1.1000	3.0000	6.0000	2.0000	30.000	-1.0000	0.	0.	0.	0.	.19643	.25000	.30357	.25000
1005.0	1.1000	7.0000	13.000	3.0000	28.000	0.	0.	0.	0.	0.	.27273	.25000	.31818	.36364
1010.0	1.1000	11.000	0.	0.	30.000	0.	0.	0.	0.	0.	.26667	.29167	.30000	.40000
1012.0	1.1000	3.0000	8.0000	4.0000	32.000	0.	0.	0.	0.	0.	.15000	.20833	.21667	.30000
1014.0	1.1000	7.0000	9.0000	-3.5000	28.000	0.	0.	0.	0.	0.	.18966	.24138	.27586	.27586
1015.0	1.1000	8.0000	10.000	7.5000	30.000	-10.000	0.	0.	0.	0.	.17188	.18750	.17188	.18750
1016.0	1.1000	6.0000	9.0000	-1.0000	29.000	0.	0.	0.	0.	0.	.19672	.26230	.24590	.31148
1017.0	1.1000	8.0000	2.0000	-8.0000	25.000	-3.0000	0.	0.	0.	0.	.17647	.25000	.20588	.20588
1018.0	1.1000	9.0000	6.0000	2.0000	34.000	-1.0000	0.	0.	0.	0.	.19444	.15278	.15278	.19444
1022.0	1.1000	4.0000	14.000	6.5000	28.000	0.	0.	0.	0.	0.	.20000	.23333	.21667	.25000
1024.0	1.1000	3.0000	10.000	6.0000	26.000	-2.0000	0.	0.	0.	0.	.25000	.32813	.26563	.26563
1027.0	1.1000	3.0000	9.0000	5.0000	28.000	0.	0.	0.	0.	0.	.26667	.31667	.23333	.31667
1028.0	1.1000	9.0000	12.000	0.	40.000	2.0000	0.	0.	0.	0.	.15000	.21667	.15000	.26667
1030.0	1.1000	3.0000	-2.0000	-6.0000	32.000	0.	0.	0.	0.	0.	.23214	.23214	.25000	.26786
1031.0	1.1000	9.0000	6.0000	-4.0000	31.000	0.	0.	0.	0.	0.	.21667	.20000	.21667	.23333
1033.0	1.1000	8.0000	-2.0000	-12.000	34.000	2.0000	0.	0.	0.	0.	.28571	.17857	.19643	.25000
1034.0	1.1000	1.0000	8.0000	5.5000	20.000	-9.0000	0.	0.	0.	0.	.19643	.19643	.23214	.25000
1040.0	1.1000	9.0000	12.000	6.0000	29.000	.50000	0.	0.	0.	0.	.18462	.24615	.27692	.27692
1043.0	1.1000	3.0000	14.000	12.000	25.000	-3.0000	0.	0.	0.	0.	.19643	.19643	.19643	.23214
1045.0	1.1000	3.0000	13.000	9.0000	26.000	-2.0000	0.	0.	0.	0.	.21875	.25000	.23438	.26563
1046.0	1.1000	9.0000	16.000	6.0000	29.000	0.	0.	0.	0.	0.	.36111	.44444	.44444	.47222
1060.0	1.1000	9.0000	1.0000	-5.0000	34.500	6.0000	0.	0.	0.	0.	.21875	.29688	.28125	.37500
1063.0	1.1000	6.0000	3.0000	-9.5000	31.000	0.	0.	0.	0.	0.	.25000	.21667	.20000	.28333
1064.0	1.1000	9.0000	5.0000	-3.0000	23.000	-3.0000	0.	0.	0.	0.	.25000	.23438	.29688	.25000
1065.0	1.1000	5.0000	4.0000	-2.0000	29.000	0.	0.	0.	0.	0.	.17188	.29688	.25000	.25000
1067.0	1.1000	9.0000	12.000	2.0000	31.000	0.	0.	0.	0.	0.	.11719	.26563	.23438	.25000
1068.0	1.1000	3.0000	10.000	2.0000	30.000	-1.0000	0.	0.	0.	0.	.21528	.10972	.23611	.29167
1073.0	1.1000	3.0000	11.000	5.0000	36.000	2.0000	0.	0.	0.	0.	.19118	.11765	.22059	.22794
1075.0	1.1000	1.0000	6.0000	1.0000	27.000	-2.0000	0.	0.	0.	0.	.20270	.28378	.24324	.31081
1077.0	1.1000	7.0000	0.	-2.5000	45.000	0.	0.	0.	0.	0.	.19643	.32143	.31250	.27679
1079.0	1.1000	9.0000	-2.0000	-8.0000	35.000	7.0000	0.	0.	0.	0.	.28333	.23333	.25833	.25000
1085.0	1.1000	6.0000	13.000	3.0000	31.000	0.	0.	0.	0.	0.	.17188	.17188	.17188	.31250
1087.0	1.1000	9.0000	7.0000	1.0000	34.000	3.0000	0.	0.	0.	0.	.33824	.26471	.27941	.34559
1090.0	1.1000	8.0000	2.0000	-.50000	35.000	-5.0000	0.	0.	0.	0.	.16667	.16667	.16667	.23611
1094.0	1.1000	11.000	0.	-5.0000	29.000	0.	0.	0.	0.	0.	.29688	.35938	.34375	.42188
1095.0	1.1000	9.0000	26.000	14.000	39.000	0.	0.	0.	0.	0.	.19118	.17647	.22059	.26471
1096.0	1.1000	9.0000	7.0000	-5.0000	34.000	-3.0000	0.	0.	0.	0.	.13235	.26471	.19853	.24265
1098.0	1.1000	3.0000	13.000	9.0000	27.000	-1.0000	0.	0.	0.	0.	.15789	.19737	.17105	.19737
1099.0	1.1000	6.0000	17.000	4.5000	35.000	2.0000	0.	0.	0.	0.	.21528	.16667	.18056	.25694
1101.0	1.1000	1.0000	10.000	7.5000	26.000	-3.0000	0.	0.	0.	0.	.18421	.23684	.21053	.25000
1102.0	1.1000	4.0000	4.0000	-1.0000	29.000	0.	0.	0.	0.	0.	.14706	.22059	.15735	.25000
1104.0	1.1000	9.0000	0.	-6.0000	37.000	0.	0.	0.	0.	0.	.26667	.28333	.26667	.29167
1107.0	1.1000	11.000	0.	5.0000	29.000	0.	0.	0.	0.	0.	.20161	.20161	.19355	.25806
1108.0	1.1000	9.0000	-0.	-0.	37.500	0.	0.	0.	0.	0.	.22727	.42424	.46970	.29545
1110.0	1.1000	11.000	5.0000	0.	30.000	-1.0000	0.	0.	0.	0.	.16406	.24219	.18750	.28906
1111.0	1.1000	9.0000	8.0000	-2.0000	26.000	0.	0.	0.	0.	0.	.22727	.21212	.21212	.25758
1112.0	1.1000	12.000	0.	-10.000	45.000	-2.0000	0.	0.	0.	0.	.20536	.30357	.27679	.28571
1114.0	1.1000	3.0000	16.000	12.000	29.000	-2.0000	0.	0.	0.	0.	.14583	.16667	.18750	.23611
1115.0	1.1000	5.0000	0.	-6.0000	31.000	0.	0.	0.	0.	0.	.25758	.46970	.36364	.34848
1116.0	1.1000	9.0000	0.	-6.0000	25.000	-1.0000	0.	0.	0.	0.	.28448	.29310	.27586	.37069
1124.0	1.1000	3.0000	10.000	6.0000	28.000	0.	0.	0.	0.	0.	.23333	.21667	.24167	.24167
1125.0	1.1000	8.0000	16.000	6.0000	25.000	-3.0000	0.	0.	0.	0.	.28333	.29167	.34167	.29167
1126.0	1.1000	7.0000	5.0000	-5.0000	31.000	0.	0.	0.	0.	0.	.21667	.29167	.25833	.35833
1128.0	1.1000	3.0000	4.0000	0.	31.000	0.	0.	0.	0.	0.	.22917	.27778	.25694	.38889
1133.0	1.1000	5.0000	0.	-6.0000	32.000	0.	0.	0.	0.	0.	.29688	.43750	.40625	.42969
1134.0	1.1000	12.000	3.0000	-7.0000	47.000	-1.0000	0.	0.	0.	0.	.16912	.18382	.15441	.19118
1135.0	1.1000	3.0000	20.000	12.000	25.000	-6.0000	0.	0.	0.	0.	.15909	.29545	.28030	.25758
1136.0	1.1000	9.0000	10.000	4.0000	27.000	0.	0.	0.	0.	0.	.20000	.28333	.28333	.35000
1137.0	1.1000	12.000	0.	-7.5000	48.000	0.	0.	0.	0.	0.	.17763	.26316	.21053	.22368
1138.0	1.1000	9.0000	20.000	14.000	20.000	-6.0000	0.	0.	0.	0.	.29412	.26471	.25735	.31618
1140.0	1.1000	4.0000	0.	-6.0000	37.000	3.0000	0.	0.	0.	0.	.15972	.27778	.27083	.27083
1142.0	1.1000	1.0000	2.5000	0.	43.500	12.500	0.	0.	0.	0.	.26250	.30000	.33750	.40000
1143.0	1.1000	2.0000	6.0000	1.0000	27.000	-1.0000	0.	0.	0.	0.	.35294	.41176	.39706	.42647
1144.0	1.1000	2.0000	10.000	5.0000	30.000	0.	0.	0.	0.	0.	.23529	.29412	.26471	.36765
1145.0	1.1000	3.0000	9.0000	5.0000	32.000	0.	0.	0.	0.	0.	.17647	.27941	.25000	.25735

TABLE 1

SUMMARY OF TEST DATA

FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	IG TIMG MS	IG TIMG DV	PT DWEL MS	PT DWEL DV	SPARK LINE	MISFIRE D1	MISFIRE D2	MISFIRE D3	RQ VOLT MS/ COIL AV MS	RQ VOLT D1/ COIL AV MS	RQ VOLT D2/ COIL AV MS	RQ VOLT D3/ COIL AV MS
1146.0	1.1000	12.000	0.	-7.5000	55.000	2.0000	0.	0.	0.	0.	.26000	.33000	.29000	.26000
1147.0	1.1000	5.0000	6.0000	0.	27.000	-1.0000	0.	0.	0.	0.	.17647	.20588	.22059	.25735
1149.0	1.1000	3.0000	11.000	3.0000	29.000	0.	0.	0.	0.	0.	.25806	.32258	.29839	.32258
1150.0	1.1000	2.0000	14.000	9.0000	25.000	-3.0000	0.	0.	0.	0.	.17143	.17143	.16429	.22857
1152.0	1.1000	8.0000	-0.	-0.	26.000	-2.0000	0.	0.	0.	0.	.20333	.16667	.14861	.20833
1155.0	1.1000	8.0000	6.0000	-4.0000	25.000	-2.0000	0.	0.	0.	0.	.26389	.26389	.33333	.33333
1156.0	1.1000	9.0000	9.0000	3.0000	29.000	.50000	1.0000	0.	0.	0.	.19118	.26588	.23529	.32353
1157.0	1.1000	3.0000	12.000	7.0000	35.000	0.	0.	0.	0.	0.	.35185	.44444	.44444	.48148
1158.0	1.1000	12.000	3.0000	-4.5000	52.000	0.	0.	0.	0.	0.	.22368	.22368	.22368	.31579
1159.0	1.1000	7.0000	5.0000	2.5000	40.000	0.	1.0000	16.800	15.300	7.4000	.10526	.14474	.15132	.17105
1162.0	1.1000	9.0000	0.	-6.0000	30.500	0.	0.	0.	0.	0.	.29167	.30556	.34722	.38889
1164.0	1.1000	9.0000	11.000	1.0000	20.000	0.	0.	0.	0.	0.	.22222	.25000	.26852	.37037
1165.0	1.1000	8.0000	12.000	2.0000	30.000	0.	0.	0.	0.	0.	.17647	.19118	.16912	.22059
1166.0	1.1000	5.0000	2.0000	-4.0000	29.000	0.	0.	0.	0.	0.	.23333	.48333	.33333	.31667
1167.0	1.1000	3.0000	15.000	11.000	30.000	0.	0.	0.	0.	0.	.13194	.17361	.18750	.20833
1170.0	1.1000	5.0000	4.0000	-2.0000	27.000	-1.0000	0.	0.	0.	0.	.33929	.31250	.32143	.35714
1173.0	1.1000	9.0000	0.	-6.0000	45.000	14.000	0.	0.	0.	0.	.18421	.17763	.15789	.23684
1179.0	1.1000	3.0000	.50000	-3.5000	24.000	-4.0000	0.	0.	0.	0.	.20270	.25676	.23649	.24324
1180.0	1.1000	3.0000	15.000	2.0000	31.000	0.	0.	0.	0.	0.	.23026	.29605	.27632	.25000
1184.0	1.1000	5.0000	-4.0000	-10.000	45.000	13.000	0.	0.	0.	0.	.25000	.27586	.36207	.36207
1187.0	1.1000	3.0000	10.300	6.0000	22.000	-6.0000	0.	12.300	12.900	14.700	.16667	.26389	.25000	.20833
1189.0	1.1000	5.0000	15.000	9.0000	32.000	0.	0.	0.	0.	0.	.34821	.40179	.37500	.41964
1190.0	1.1000	4.0000	4.0000	-1.0000	33.000	1.0000	0.	15.300	17.100	14.200	.20000	.30000	.27500	.29167
1200.0	1.1000	7.0000	10.000	7.5000	36.000	-4.0000	0.	0.	0.	0.	.19355	.20968	.22581	.31452
1204.0	1.1000	3.0000	14.000	10.000	31.500	0.	0.	0.	0.	0.	.17188	.31250	.32813	.26563
1206.0	1.1000	4.0000	-5.0000	-10.000	29.000	0.	0.	0.	0.	0.	.25926	.50000	.38889	.35185
1208.0	1.1000	10.000	-0.	-0.	26.000	0.	0.	0.	0.	0.	.31250	.41071	.45714	.42857
1209.0	1.1000	9.0000	0.	-6.0000	27.000	0.	0.	0.	0.	0.	.19444	.18056	.16667	.23611
1210.0	1.1000	10.000	15.000	5.0000	38.000	0.	0.	0.	0.	0.	.31250	.31250	.25000	.35938
1213.0	1.1000	10.000	4.0000	-6.0000	28.000	0.	0.	0.	0.	0.	.23438	.31250	.32813	.31250
1214.0	1.1000	3.0000	3.0000	-1.0000	31.000	0.	0.	0.	0.	0.	.25000	.29167	.29167	.36111
1216.0	1.1000	10.000	6.0000	2.0000	24.000	-2.0000	0.	0.	0.	0.	.20395	.21053	.19737	.28947
1218.0	1.1000	4.0000	7.0000	-.50000	27.000	-1.0000	0.	0.	0.	0.	.20313	.20994	.27344	.26563
1219.0	1.1000	3.0000	13.000	0.	30.000	-1.0000	0.	0.	0.	0.	.27941	.45588	.31618	.36765
1220.0	1.1000	3.0000	0.	-14.000	32.000	0.	0.	0.	0.	0.	.20000	.36667	.30833	.35000
1223.0	1.1000	4.0000	-0.	-0.	32.000	0.	0.	0.	0.	0.	.17105	.15132	.15789	.16447
1226.0	1.1000	3.0000	-0.	-0.	31.000	0.	0.	0.	0.	0.	.20313	.23438	.35938	.37500
1227.0	1.1000	5.0000	8.0000	2.0000	45.000	13.000	0.	0.	0.	0.	.21324	.22059	.25735	.26471
1228.0	1.1000	3.0000	7.0000	3.0000	30.000	0.	0.	0.	0.	0.	.16667	.26389	.25694	.28472
1230.0	1.1000	1.0000	15.000	12.500	25.000	-4.0000	0.	0.	0.	0.	.17500	.18333	.23333	.26667
1233.0	1.1000	7.0000	6.0000	1.0000	41.000	0.	0.	0.	0.	0.	.17857	.17143	.16857	.29286
1234.0	1.1000	9.0000	6.0000	0.	20.000	-6.0000	0.	0.	0.	0.	.23529	.33824	.27941	.26471
1235.0	1.1000	10.000	10.000	-2.0000	60.000	22.000	0.	0.	0.	0.	.17424	.27273	.18182	.25000
1236.0	1.1000	3.0000	0.	-4.0000	31.000	0.	0.	0.	0.	0.	.20690	.27586	.20640	.32759
1238.0	1.1000	4.0000	6.0000	-1.5000	31.500	0.	0.	0.	0.	0.	.18919	.24324	.27027	.22973
1239.0	1.1000	9.0000	0.	-8.0000	27.500	0.	0.	0.	0.	0.	.19531	.21875	.23438	.29688
1240.0	1.1000	4.0000	10.000	2.5000	33.000	1.0000	0.	0.	0.	0.	.25000	.32353	.33088	.34559
1241.0	1.1000	9.0000	9.0000	-3.0000	36.000	0.	0.	0.	0.	0.	.17143	.21429	.18571	.17143
1242.0	1.1000	9.0000	9.0000	-3.0000	37.000	0.	0.	0.	0.	0.	.19853	.33824	.31618	.30882
1243.0	1.1000	3.0000	0.	-6.0000	36.000	2.0000	0.	0.	0.	0.	.16176	.30882	.30882	.33824
1244.0	1.1000	1.0000	10.000	7.5000	28.000	-1.0000	0.	0.	0.	0.	.20788	.32576	.31818	.24091
1245.0	1.1000	2.0000	7.0000	2.0000	29.500	0.	0.	0.	0.	0.	.27083	.25000	.20833	.25000
1246.0	1.1000	9.0000	14.000	4.0000	27.000	0.	0.	0.	0.	0.	.21053	.23684	.23026	.25000
1247.0	1.1000	9.0000	12.000	2.0000	13.000	-13.000	0.	0.	0.	0.	.35000	.37500	.42500	.48750
1248.0	1.1000	1.0000	3.0000	.50000	33.000	2.0000	0.	0.	0.	0.	.19853	[illegible]	[illegible]	[illegible]
1249.0	1.1000	1.0000	10.000	-2.0000	21.000	-8.0000	0.	0.	0.	0.	.23214	.37500	.30357	.32143
1250.0	1.1000	7.0000	10.000	2.0000	29.000	0.	0.	0.	0.	0.	.21429	.21094	.21879	.29688
1252.0	1.1000	3.0000	6.0000	-7.0000	29.000	-2.0000	0.	0.	0.	0.	.31429	.47857	.35714	.42857
1253.0	1.1000	8.0000	15.000	13.000	45.000	0.	1.0000	0.	0.	0.	-0.	-0.	-0.	-0.
1255.0	1.1000	5.0000	3.0000	-3.0000	22.000	-4.0000	1.0000	15.000	13.900	16.800	.20000	.26667	.29833	.30000
1256.0	1.1000	4.0000	14.000	9.0000	[illegible]	0.	0.	0.	0.	0.	.21583	[illegible]	.31700	[illegible]
1258.0	1.1000	5.0000	-0.	-0.	30.000	0.	0.	0.	0.	0.	.27264	.43750	.30208	[illegible]
1259.0	1.1000	3.0000	10.000	6.0000	25.000	-3.0000	1.0000	[illegible]	16.300	16.200	.25000	.30882	.27951	[illegible]
1260.0	1.1000	9.0000	6.0000	0.	22.000	-4.0000	1.0000	0.	0.	0.	.25000	.25000	.18333	.29167

FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. I

CAR NO	TEST NO	CAR MAKE	IG TIMG MS	IG TIMG DV	PT DWEL MS	PT DWEL DV	SPARK LINE	MISFIRE D1	MISFIRE D2	MISFIRE D3	RQ VOLT MS/ COIL AV MS	RQ VOLT D1/ COIL AV MS	RQ VOLT D2/ COIL AV MS	RQ VOLT D3/ COIL AV MS
ESTIMATE OF MEAN			7.2137	.62097	31.269	-.27308	4.61538E-02	.55692	.58077	.53308	.22649	.26969	.26068	.29583
ESTIMATE OF STANDARD DEVIATION			5.7531	6.0544	7.0407	4.0367	.21063	2.8137	2.9307	2.7566	5.32954E-02	6.07000E-02	7.03630E-02	6.74501E-02
DEGREES OF FREEDOM			123	123	129	129	129	129	129	129	128	128	128	128
T VALUE			13.963	1.1421	50.352	-.77131	2.4984	2.2568	2.2505	2.2049	46.989	37.956	42.078	49.814

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	TEST NO	REPAIR	IHPM MS	IHPM DV	AIR CLN MS	AIR CLN D1	AIR CLN D2	CH KICK MS	CH KICK DV	HEAT RISER	DIAPHRAGM	FLT LEV MS	PLT LEV DV	PCV PERF	PCV FLO D1	PCV FLO D2	MOX CNTRL
1002.0	1.1000	0.	525.00	25.000	92.730	1.0000	.20000	9.50000E-02	-1.50000E-02	0.	0.	.72000	-3.00000E-02	-5.00000E-02	2.5382	2.1756	-1.0000
1004.0	1.1000	0.	650.00	0.	113.41	2.5000	1.5000	.11000	-2.60000E-02	1.0000	0.	1.2810	0.	-5.00000E-02	4.4030	3.1080	-1.0000
1005.0	1.1000	0.	625.00	125.00	86.757	0.	0.	-0.	-0.	0.	1.0000	.25000	0.	0.	2.3310	1.8130	-1.0000
1010.0	1.1000	0.	625.00	25.000	81.018	.50000	.20000	-0.	-0.	1.0000	-1.0000	.40000	8.80000E-02	0.	2.6936	1.2950	-1.0000
1012.0	1.1000	0.	500.00	0.	-0.	-0.	-0.	.11000	-.12000	1.0000	1.0000	1.2500	-3.10000E-02	-1.00000E-02	3.8850	1.2950	-1.0000
1014.0	1.1000	0.	600.00	100.00	70.240	1.0000	.50000	-0.	-0.	1.0000	1.0000	.28000	6.20000E-02	-5.00000E-02	2.5382	1.2950	-1.0000
1015.0	1.1000	0.	525.00	-25.000	105.38	1.5000	.50000	.10000	-1.00000E-03	1.0000	0.	.79600	-3.20000E-02	-0.	2.5900	1.2950	-1.0000
1016.0	1.1000	0.	450.00	-100.00	86.757	.60000	.40000	-0.	-0.	1.0000	-1.0000	.25000	.12500	0.	-0.	-0.	-1.0000
1017.0	1.1000	0.	775.00	75.000	86.757	.50000	0.	-0.	-0.	1.0000	1.0000	.23000	-2.00000E-02	-.10000	2.8490	-0.	-1.0000
1018.0	1.1000	0.	750.00	200.00	92.730	1.5000	.50000	-0.	-0.	0.	-1.0000	1.6000	-0.	-4.00000E-02	-0.	-0.	-1.0000
1022.0	1.1000	0.	500.00	-75.000	86.757	1.0000	.20000	-0.	-0.	0.	1.0000	6.00000E-0	-.19000	-2.00000E-02	2.6936	1.8130	-1.0000
1024.0	1.1000	0.	600.00	100.00	55.824	.60000	.20000	-0.	-0.	0.	1.0000	.75000	0.	-2.00000E-02	-0.	-0.	-1.0000
1027.0	1.1000	0.	500.00	0.	105.38	1.5000	.50000	.11000	-.10500	1.0000	0.	.75000	0.	0.	2.5900	1.2950	-1.0000
1028.0	1.1000	0.	500.00	0.	98.936	2.0000	.50000	.17000	1.00000E-02	-1.0000	-1.0000	1.0150	-.17200	-2.00000E-02	-0.	-0.	-1.0000
1030.0	1.1000	0.	450.00	-50.000	112.05	2.0000	.50000	9.50000E-02	-4.50000E-02	1.0000	0.	-0.	-0.	-5.00000E-02	5.1800	1.8130	-1.0000
1031.0	1.1000	0.	550.00	75.000	98.936	1.5000	.20000	7.00000E-02	-4.00000E-02	-1.0000	-1.0000	.37500	-3.10000E-02	0.	2.0720	1.5940	-1.0000
1033.0	1.1000	0.	625.00	125.00	86.757	.20000	0.	.16000	3.50000E-02	1.0000	0.	.20000	-5.00000E-02	-5.00000E-02	2.3310	2.0720	-1.0000
1034.0	1.1000	0.	675.00	175.00	98.936	1.0000	.50000	-0.	-0.	0.	-1.0000	1.4060	0.	2.00000E-02	2.0720	2.0720	-1.0000
1040.0	1.1000	0.	500.00	0.	51.485	5.00000E-02	0.	.23000	4.30000E-02	-1.0000	-1.0000	.87500	0.	0.	3.6260	2.5900	-1.0000
1043.0	1.1000	0.	675.00	175.00	17.626	.50000	0.	7.00000E-02	-9.00000E-02	1.0000	0.	.25000	-3.10000E-02	-0.	2.0720	1.8130	-1.0000
1045.0	1.1000	0.	475.00	-25.000	30.354	.20000	0.	.10000	-.11500	1.0000	0.	.64000	-.11300	0.	2.3310	1.8130	-1.0000
1046.0	1.1000	0.	700.00	200.00	98.936	1.0000	.20000	.12000	-1.00000E-02	-1.0000	-1.0000	.87500	.34400	-1.00000E-02	5.4390	5.1800	-1.0000
1060.0	1.1000	0.	550.00	50.000	30.354	.40000	0.	.12000	-6.70000E-02	-1.0000	-1.0000	.87500	0.	-.25000	6.2160	5.1800	-1.0000
1063.0	1.1000	0.	600.00	50.000	15.250	0.	0.	-0.	-0.	0.	1.0000	.25000	9.40000E-02	-5.00000E-02	2.5900	2.3310	-1.0000
1064.0	1.1000	0.	550.00	75.000	86.757	.10000	0.	.10000	-5.60000E-02	-1.0000	-1.0000	.93700	3.10000E-02	-0.	-0.	-0.	-1.0000
1065.0	1.1000	0.	575.00	75.000	133.47	.50000	.30000	8.00000E-02	-8.00000E-02	1.0000	-1.0000	.65800	6.30000E-02	-2.00000E-02	2.6418	2.5382	-1.0000
1067.0	1.1000	0.	550.00	-25.000	105.38	.50000	.20000	1.50000E-02	-0.	-1.0000	-1.0000	-0.	-0.	-.35000	5.1800	2.5900	-1.0000
1068.0	1.1000	0.	500.00	0.	92.730	.50000	.40000	.11000	-3.00000E-02	1.0000	0.	-0.	-0.	-0.	3.6260	1.5540	-1.0000
1073.0	1.1000	0.	1150.0	650.00	60.396	-0.	-0.	-0.	-0.	-1.0000	1.0000	1.0930	3.10000E-02	0.	-0.	-0.	-1.0000
1075.0	1.1000	0.	725.00	125.00	98.936	.50000	0.	[illegible]	-2.50000E-02	1.0000	-1.0000	1.3120	3.10000E-02	-.10000	2.5900	1.2950	-1.0000
1077.0	1.1000	0.	525.00	-25.000	92.730	1.5000	.50000	.25000	2.20000E-02	0.	-1.0000	-0.	-0.	0.	3.8850	1.2950	-1.0000
1079.0	1.1000	0.	650.00	150.00	141.07	.50000	0.	8.00000E-02	-3.00000E-02	-1.0000	-1.0000	.75000	-.12500	0.	0.	0.	-1.0000
1085.0	1.1000	0.	525.00	25.000	30.354	0.	0.	-0.	-0.	0.	1.0000	.26000	4.20000E-02	0.	2.3310	2.3310	-1.0000
1087.0	1.1000	0.	600.00	100.00	65.201	0.	0.	.10000	-1.00000E-02	-1.0000	-1.0000	.90000	3.10000E-02	0.	2.5900	.51800	-1.0000
1090.0	1.1000	0.	625.00	-25.000	36.444	0.	0.	-0.	-0.	1.0000	1.0000	.96800	.12500	0.	1.5540	1.0360	-1.0000
1094.0	1.1000	0.	650.00	150.00	120.00	1.0000	.50000	.17000	4.50000E-02	-1.0000	-1.0000	.18700	3.10000E-02	-0.	-0.	-0.	-1.0000
1095.0	1.1000	0.	600.00	75.000	135.00	.50000	.50000	9.50000E-02	-4.50000E-02	-1.0000	-1.0000	1.1250	3.20000E-02	-5.00000E-02	2.8490	1.5540	-1.0000
1096.0	1.1000	0.	700.00	200.00	70.000	1.5000	.50000	.14000	0.	-1.0000	-1.0000	1.0460	-4.70000E-02	0.	2.0720	.77700	-1.0000
1098.0	1.1000	0.	575.00	125.00	0.	1.0000	.50000	.15000	-1.00000E-01	1.0000	-1.0000	1.4680	-6.30000E-02	-.25000	-0.	-0.	-1.0000
1099.0	1.1000	0.	575.00	75.000	15.000	.50000	0.	.14000	-.23500	0.	0.	.37500	.15700	-2.00000E-02	2.3310	2.0720	-1.0000
1101.0	1.1000	0.	600.00	50.000	30.000	.50000	0.	.12000	3.50000E-02	1.0000	-1.0000	.56200	6.20000E-02	5.00000E-02	0.	0.	-1.0000
1102.0	1.1000	0.	450.00	-50.000	20.000	.50000	0.	1.00000E-02	-5.00000E-02	1.0000	-1.0000	1.2500	-.21800	-.20000	1.0360	1.0360	-1.0000
1104.0	1.1000	0.	625.00	25.000	70.000	1.5000	.50000	.11000	-2.00000E-02	-1.0000	-1.0000	.87500	-.21800	-5.00000E-02	3.8850	2.0720	-1.0000
1107.0	1.1000	0.	575.00	75.000	40.000	.50000	0.	.20000	1.30000E-02	1.0000	-1.0000	.20000	-0.	-0.	-0.	-0.	-1.0000
1108.0	1.1000	0.	475.00	-25.000	110.00	1.0000	.50000	-0.	-0.	-1.0000	-1.0000	.96800	-3.20000E-02	-0.	-0.	-0.	-1.0000
1110.0	1.1000	0.	725.00	225.00	70.000	.50000	.20000	.10000	-8.70000E-02	1.0000	-1.0000	.19000	-6.00000E-02	-.10000	1.2950	1.0360	-1.0000
1111.0	1.1000	0.	625.00	125.00	90.000	1.0000	.50000	8.50000E-02	-7.10000E-02	-1.0000	-1.0000	.96800	6.20000E-02	-0.	-0.	-0.	-1.0000
1112.0	1.1000	0.	1100.0	550.00	-0.	-0.	-0.	-0.	-0.	-1.0000	-1.0000	.56200	-0.	-0.	-0.	-0.	-1.0000
1114.0	1.1000	0.	575.00	75.000	160.00	2.0000	1.0000	.11000	-.12000	1.0000	0.	1.2810	0.	-5.00000E-02	1.2950	1.0360	-1.0000
1115.0	1.1000	0.	525.00	25.000	40.000	2.0000	.50000	.14000	-2.00000E-02	1.0000	-1.0000	.87500	.31300	-5.00000E-02	1.8130	1.5540	-1.0000
1116.0	1.1000	0.	550.00	50.000	105.00	1.0000	0.	.12000	0.	-1.0000	-1.0000	.75000	-.12500	-0.	-0.	-0.	-1.0000
1124.0	1.1000	0.	575.00	125.00	30.000	.50000	.25000	.16000	-9.00000E-02	0.	-1.0000	1.5000	-3.10000E-02	-.10000	-0.	-0.	-1.0000
1125.0	1.1000	0.	525.00	25.000	30.000	1.0000	.50000	-0.	-0.	1.0000	-1.0000	.31200	9.40000E-02	0.	1.2950	1.2950	-1.0000
1126.0	1.1000	0.	675.00	175.00	30.000	.50000	.50000	.27500	-3.70000E-02	1.0000	0.	.18700	-3.10000E-02	5.00000E-02	3.1080	.51800	-1.0000
1128.0	1.1000	0.	600.00	150.00	30.000	1.0000	.25000	9.50000E-02	-.10500	1.0000	0.	.75000	0.	-.25000	2.8490	[illegible]	-1.0000
1133.0	1.1000	0.	575.00	75.000	-0.	1.0000	.50000	.12000	-4.00000E-02	1.0000	-1.0000	.87500	.25000	0.	2.5900	1.8130	-1.0000
1134.0	1.1000	0.	1175.0	625.00	-0.	-0.	-0.	-0.	-0.	0.	-1.0000	.75000	-0.	-0.	-0.	-0.	-1.0000
1135.0	1.1000	0.	725.00	225.00	0.	2.0000	.50000	.11000	-3.00000E-02	1.0000	0.	1.2500	-3.10000E-02	0.	2.8490	1.8130	-1.0000
1136.0	1.1000	0.	425.00	-50.000	125.00	1.0000	.25000	.11000	0.	-1.0000	-1.0000	.81200	-6.30000E-02	.10000	3.8850	2.3310	-1.0000
1137.0	1.1000	0.	975.00	425.00	-0.	-0.	-0.	-0.	-0.	-1.0000	-1.0000	.62500	-0.	-0.	-0.	-0.	-1.0000
1138.0	1.1000	0.	700.00	200.00	65.000	1.5000	1.0000	.11000	-2.00000E-02	-1.0000	-1.0000	.75000	-.12500	.10000	-0.	-0.	-1.0000
1140.0	1.1000	0.	600.00	100.00	95.000	1.5000	.50000	-0.	-0.	1.0000	1.0000	1.2180	-6.30000E-02	0.	3.1080	[illegible]	[illegible]
1142.0	1.1000	0.	525.00	25.000	.30000	.10000	.25000	[illegible]	-.13800	1.0000	-1.0000	.18000	[illegible]	-.20000	3.8850	[illegible]	[illegible]
1143.0	1.1000	0.	600.00	120.00	35.000	1.0000	.25000	8.50000E-02	-.18600	-1.0000	-1.0000	.32500	-5.00000E-02	-.15000	-0.	-0.	-1.0000
1144.0	1.1000	0.	650.00	150.00	65.000	1.5000	.25000	.16000	-2.00000E-02	-1.0000	0.	.12500	-.10900	-.30000	1.2950	10.360	-1.0000
1145.0	1.1000	0.	550.00	75.000	0.	1.5000	.50000	.12000	-.24000	1.0000	-1.0000	.18000	-1.5070	-0.	-0.	-0.	-1.0000

TABLE 1
SUMMARY OF TEST DATA

FLEET 1 DETROIT

TABULATION OF CNC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	TEST NO	REPAIR	IRPM MS	IRPM DV	AIR CLN MS	AIR CLN D1	AIR CLN D2	CM KICK MS	CM KICK DV	HEAT RISER	DIAPHRAGM	FLT LEV MS	FLT LEV DV	PCV PERF	PCV FLO D1	PCV FLO D2	NOX CNTRL
1146.0	1.1000	0.	850.00	300.00	-0.	-0.	-0.	-0.	-0.	-1.0000	-1.0000	.62500	-0.	0.	-0.	-0.	-1.0000
1147.0	1.1000	0.	525.00	25.000	-0.	1.5000	.50000	.11000	-5.00000E-02	1.0000	-1.0000	.75000	.12500	0.	3.6850	0.	-1.0000
1149.0	1.1000	0.	525.00	25.000	-0.	0.	0.	.11000	-.15000	1.0000	0.	-0.	-0.	-.10000	1.8130	1.2950	-1.0000
1150.0	1.1000	0.	625.00	145.00	0.	2.0000	1.0000	.11300	-7.00000E-02	-1.0000	-1.0000	.27500	4.10000E-02	-.20000	2.8490	1.2950	-1.0000
1152.0	1.1000	0.	1025.0	425.00	30.000	1.0000	.50000	.16000	2.00000E-02	1.0000	0.	.31200	6.20000E-02	-.50000	4.1440	2.5900	-1.0000
1155.0	1.1000	0.	675.00	175.00	50.000	.50000	.25000	.20000	-9.60000E-02	1.0000	-1.0000	.37500	.15700	-1.3000	3.8850	3.6260	-1.0000
1156.0	1.1000	0.	575.00	75.000	110.00	1.5000	1.0000	8.00000E-02	-3.00000E-02	-1.0000	-1.0000	.93700	3.10000E-02	5.00000E-02	4.1440	4.1440	-1.0000
1157.0	1.1000	0.	550.00	50.000	115.00	5.0000	1.2500	5.50000E-02	-.17500	1.0000	-1.0000	-0.	-0.	-0.	-0.	-0.	-1.0000
1158.0	1.1000	0.	1200.0	700.00	-0.	-0.	-0.	-0.	-0.	-1.0000	-1.0000	.50000	-0.	-0.	-0.	-0.	-1.0000
1159.0	1.1000	0.	525.00	-25.000	-0.	-0.	-0.	.12000	2.70000E-02	1.0000	-1.0000	1.0000	.15700	0.	2.8490	2.3310	-1.0000
1162.0	1.1000	0.	500.00	25.000	100.00	.50000	0.	.16000	3.00000E-02	-1.0000	-1.0000	.34300	-.53200	-.10000	2.8490	2.0720	-1.0000
1164.0	1.1000	0.	650.00	150.00	65.000	1.0000	.50000	.14000	-1.60000E-02	-1.0000	-1.0000	.87500	-3.10000E-02	.10000	-0.	-0.	-1.0000
1165.0	1.1000	0.	500.00	0.	60.000	1.0000	.25000	-0.	-0.	1.0000	-1.0000	.25000	-6.20000E-02	5.00000E-02	1.5540	1.2950	-1.0000
1166.0	1.1000	0.	600.00	0.	0.	.50000	0.	8.00000E-02	-8.00000E-02	1.0000	-1.0000	.68700	.12500	.10000	2.8490	1.8130	-1.0000
1167.0	1.1000	0.	475.00	25.000	155.00	.75000	.50000	.20000	-.17000	0.	-1.0000	.56200	-.18800	-.20000	2.0720	2.0720	-1.0000
1170.0	1.1000	0.	775.00	275.00	25.000	1.0000	.25000	.14000	-1.60000E-02	1.0000	-1.0000	.37500	6.30000E-02	-2.00000E-02	2.3310	2.0720	-1.0000
1173.0	1.1000	0.	525.00	50.000	85.000	1.5000	.10000	.14000	1.00000E-02	-1.0000	-1.0000	.75000	-.12500	-.20000	5.1800	3.1080	-1.0000
1179.0	1.1000	0.	525.00	25.000	100.00	1.0000	.50000	.11000	-.25000	1.0000	-1.0000	.78100	3.10000E-02	-.25000	-0.	-0.	-1.0000
1180.0	1.1000	0.	800.00	300.00	-0.	-0.	-0.	-0.	-0.	-1.0000	-1.0000	1.1250	-9.30000E-02	-0.	-0.	-0.	-1.0000
1184.0	1.1000	0.	575.00	-75.000	30.000	1.5000	.50000	.12000	-6.00000E-02	1.0000	-1.0000	.43700	-.12500	0.	4.4030	1.0360	-1.0000
1187.0	1.1000	0.	625.00	125.00	35.000	1.5000	.50000	.15000	-5.00000E-02	1.0000	0.	.87500	.12500	-.15000	2.0720	1.5540	-1.0000
1189.0	1.1000	0.	750.00	150.00	-0.	.25000	0.	.11300	-5.00000E-02	1.0000	-1.0000	.68700	9.40000E-02	-.40000	2.0720	1.2950	1.0000
1190.0	1.1000	0.	750.00	250.00	10.000	1.0000	.50000	.13000	1.50000E-02	-1.0000	-1.0000	1.5000	3.20000E-02	-.10000	-0.	-0.	-1.0000
1200.0	1.1000	0.	650.00	160.00	120.00	.50000	.25000	.11000	-7.70000E-02	0.	-1.0000	.28[illegible]	6.30000E-02	0.	-0.	-0.	-1.0000
1204.0	1.1000	0.	575.00	75.000	120.00	1.0000	.50000	.11300	-.14000	0.	0.	1.2500	-3.10000E-02	0.	3.8850	3.1080	-1.0000
1206.0	1.1000	0.	600.00	100.00	0.	.50000	0.	.13000	-3.30000E-02	-1.0000	-1.0000	.62500	-6.20000E-02	5.00000E-02	-0.	-0.	-1.0000
1208.0	1.1000	0.	600.00	100.00	35.000	1.0000	0.	.13000	-4.00000E-02	-1.0000	-1.0000	.81200	-6.30000E-02	5.00000E-02	-0.	-0.	-1.0000
1209.0	1.1000	0.	625.00	150.00	90.000	.80000	.50000	8.00000E-02	-5.00000E-02	-1.0000	-1.0000	.73400	-.14100	-.10000	5.1800	2.5900	-1.0000
1210.0	1.1000	0.	575.00	75.000	110.00	1.0000	.30000	-0.	-0.	-1.0000	-1.0000	.18700	1.60000E-02	-0.	-0.	-0.	-1.0000
1213.0	1.1000	0.	675.00	175.00	30.000	1.5000	.50000	.14000	-3.00000E-02	0.	-1.0000	.68700	-.19300	-5.00000E-02	2.8490	2.0720	-1.0000
1214.0	1.1000	0.	500.00	0.	110.00	.50000	0.	9.50000E-02	-.10500	0.	0.	.75000	0.	-.15000	2.3310	1.8130	-1.0000
1216.0	1.1000	0.	625.00	125.00	20.000	1.5000	.50000	.13000	-4.00000E-02	-1.0000	-1.0000	.68700	-.18800	-.25000	4.4030	2.5900	-1.0000
1218.0	1.1000	0.	550.00	50.000	25.000	.25000	0.	-0.	-0.	-1.0000	1.0000	.31200	-3.10000E-02	-.15000	2.3310	2.0720	-1.0000
1219.0	1.1000	0.	875.00	375.00	-0.	-0.	-0.	.10000	-6.00000E-02	-1.0000	0.	1.2500	6.30000E-02	5.00000E-02	2.5900	1.0360	-1.0000
1220.0	1.1000	0.	600.00	100.00	0.	1.0000	0.	-0.	-0.	-1.0000	1.0000	1.0620	0.	0.	-0.	-0.	-1.0000
1223.0	1.1000	0.	500.00	0.	5.0000	1.5000	.50000	.11300	-5.00000E-02	-1.0000	-1.0000	.87500	.12500	.20000	-0.	-0.	-1.0000
1226.0	1.1000	0.	975.00	475.00	70.000	2.0000	.50000	-0.	-0.	1.0000	1.0000	1.5000	.21900	0.	1.2950	1.0360	-1.0000
1227.0	1.1000	0.	600.00	100.00	0.	.50000	0.	.16000	0.	1.0000	-1.0000	.50000	-9.30000E-02	0.	3.8850	2.0720	-1.0000
1228.0	1.1000	0.	375.00	-75.000	0.	1.0000	.50000	-0.	-0.	0.	-1.0000	.87500	.12500	0.	-0.	-0.	-1.0000
1230.0	1.1000	0.	800.00	300.00	70.000	1.0000	.50000	9.50000E-02	-.12300	1.0000	-1.0000	.20000	-1.80000E-02	-5.00000E-02	2.5900	1.8130	-1.0000
1233.0	1.1000	0.	600.00	50.000	-0.	-0.	-0.	.13000	4.10000E-02	1.0000	0.	.81200	-3.10000E-02	0.	1.2950	1.2950	-1.0000
1234.0	1.1000	0.	575.00	75.000	30.000	.50000	0.	.10000	5.50000E-02	-1.0000	-1.0000	.87500	-3.10000E-02	5.00000E-02	-0.	-0.	-1.0000
1235.0	1.1000	0.	625.00	100.00	20.000	1.0000	.25000	.13000	0.	-1.0000	-1.0000	1.0600	-3.30000E-02	0.	-0.	-0.	-1.0000
1236.0	1.1000	0.	675.00	175.00	150.00	1.0000	.50000	.12300	-4.00000E-02	0.	0.	1.2500	-3.10000E-02	0.	2.3310	1.8130	-1.0000
1238.0	1.1000	0.	750.00	150.00	25.000	.25000	0.	.14000	-2.00000E-02	-1.0000	-1.0000	.62500	3.20000E-02	.15000	1.8130	1.8130	-1.0000
1239.0	1.1000	0.	500.00	25.000	40.000	.50000	0.	.11000	-4.60000E-02	-1.0000	-1.0000	.87500	-3.10000E-02	5.00000E-02	-0.	-0.	-1.0000
1240.0	1.1000	0.	600.00	160.00	0.	1.0000	.25000	.10000	-1.00000E-01	-1.0000	0.	.21800	-3.20000E-02	-1.9000	3.3670	1.8130	-1.0000
1241.0	1.1000	0.	625.00	100.00	55.000	1.0000	.50000	-0.	-0.	-1.0000	-1.0000	1.0000	0.	2.0000	0.	0.	-1.0000
1242.0	1.1000	0.	625.00	100.00	70.000	1.0000	.25000	-0.	-0.	-1.0000	-1.0000	.93700	-6.30000E-02	-0.	-0.	-0.	-1.0000
1243.0	1.1000	0.	500.00	0.	0.	1.5000	.50000	.10000	-4.00000E-02	0.	0.	1.1250	-.15600	-2.00000E-02	2.8490	2.0720	-1.0000
1244.0	1.1000	0.	500.00	-100.00	0.	1.0000	0.	9.50000E-02	-4.50000E-02	1.0000	-1.0000	.46800	0.	-5.00000E-02	3.8850	2.0720	-1.0000
1245.0	1.1000	0.	800.00	320.00	0.	1.0000	0.	.13000	5.00000E-03	1.0000	-1.0000	1.3120	-.12500	.15000	-0.	-0.	-1.0000
1246.0	1.1000	0.	600.00	100.00	70.000	.50000	0.	.16000	6.20000E-02	-1.0000	-1.0000	.59300	-.15700	5.00000E-02	2.3310	1.5540	-1.0000
1247.0	1.1000	0.	625.00	150.00	95.000	.50000	.50000	9.50000E-02	-1.40000E-02	0.	-1.0000	.87500	-3.10000E-02	.25000	-0.	-0.	-1.0000
1248.0	1.1000	0.	650.00	100.00	25.000	.50000	.25000	.15000	-5.00000E-02	0.	0.	.25000	-3.10000E-02	0.	2.3310	2.0720	-1.0000
1249.0	1.1000	0.	675.00	150.00	25.000	.50000	0.	.12000	-.13000	0.	-1.0000	.75000	3.20000E-02	0.	-0.	-0.	-1.0000
1250.0	1.1000	0.	600.00	100.00	0.	.50000	0.	.11300	-1.50000E-02	0.	0.	.31200	6.20000E-02	0.	2.3310	2.3310	-1.0000
1252.0	1.1000	0.	900.00	400.00	-0.	-0.	-0.	.14000	-2.00000E-02	-1.0000	0.	1.2500	3.20000E-02	0.	-0.	-0.	-1.0000
1253.0	1.1000	0.	425.00	-125.00	-0.	-0.	-0.	.12000	-6.70000E-02	1.0000	-1.0000	.37500	.15700	-0.	-0.	-0.	-1.0000
1255.0	1.1000	0.	400.00	-100.00	30.000	1.0000	.50000	.11000	-5.00000E-02	-1.0000	-1.0000	.68700	6.20000E-02	0.	2.3310	1.5540	-1.0000
1256.0	1.1000	0.	500.00	-50.000	110.00	.50000	.25000	.15000	-.15000	1.0000	1.0000	1.2500	-3.10000E-02	0.	1.5540	1.2950	-1.0000
1258.0	1.1000	0.	725.00	225.00	0.	.50000	0.	9.50000E-02	-6.50000E-02	0.	-1.0000	.68700	6.20000E-02	0.	3.1080	2.0720	-1.0000
1259.0	1.1000	0.	550.00	50.000	170.00	1.5000	.50000	.18700	-2.80000E-02	1.0000	0.	.75000	0.	.35000	5.1800	2.3310	-1.0000
1260.0	1.1000	0.	625.00	125.00	0.	1.0000	.75000	-0.	-0.	-1.0000	-1.0000	.84300	-3.20000E-02	0.	7.7700	2.5900	-1.0000

TABULATION OF CNC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	TEST NO	REPAIR	IRPM MS	IRPM DV	AIR CLN MS	AIR CLN D1	AIR CLN D2	CM KICK MS	CM KICK DV	HEAT RISER	DIAPHRAGM	FLT LEV MS	FLT LEV DV	PCV PERF	PCV FLO D1	PCV FLO D2	NOX CNTRL
ESTIMATE OF MEAN			624.42	108.50	61.729	.93632	.51068	.12290	-5.11429E-02	7.69231E-03	-.56154	.73639	-1.94786E-02	-4.56772E-02	2.6596	1.9565	-1.0000
ESTIMATE OF STANDARD DEVIATION			147.05	145.70	44.711	.65849	.29139	3.07044E-02	6.54299E-02	.90216	.60204	.37575	.17794	.30826	1.3189	1.2989	0.
DEGREES OF FREEDOM			129	129	113	116	116	98	97	129	129	123	116	113	67	66	129
T VALUE			48.417	8.4905	14.761	15.381	11.533	31.594	-7.7379	9.72179E-02	-9.3873	21.665	-1.1840	-1.5890	20.339	14.071	-0.

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 DETROIT

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
1001.0	70.000	3.0000	3219.0	140.00	230.00	6.0000	1.0000	0.	3.0000	4.0000	31258	6.0000
1003.0	68.000	11.000	3962.0	280.00	343.00	2.0000	4.0000	1.0000	3.0000	4.0000	51341	8.0000
1006.0	69.000	9.0000	3520.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	25182	8.0000
1007.0	70.000	8.0000	3652.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	40338	8.0000
1008.0	68.000	10.000	4000.0	265.00	390.00	7.0000	2.0000	0.	2.0000	4.0000	52035	8.0000
1009.0	71.000	11.000	2945.0	150.00	250.00	2.0000	1.0000	1.0000	3.0000	4.0000	5523.0	6.0000
1011.0	69.000	10.000	4350.0	270.00	390.00	3.0000	2.0000	1.0000	3.0000	4.0000	43656	8.0000
1013.0	70.000	7.0000	4070.0	335.00	383.00	1.0000	4.0000	1.0000	3.0000	4.0000	13114	8.0000
1019.0	70.000	7.0000	3315.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	27683	6.0000
1020.0	70.000	1.0000	3976.0	230.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	15181	8.0000
1021.0	71.000	9.0000	3680.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	13038	8.0000
1023.0	69.000	9.0000	4153.0	250.00	351.00	7.0000	2.0000	1.0000	3.0000	4.0000	26147	8.0000
1024.0	71.000	7.0000	3230.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	2378.0	6.0000
1025.0	70.000	9.0000	4404.0	270.00	390.00	7.0000	2.0000	1.0000	3.0000	4.0000	47785	8.0000
1029.0	69.000	9.0000	4153.0	270.00	390.00	7.0000	2.0000	1.0000	0.	4.0000	31815	8.0000
1032.0	71.000	8.0000	4091.0	230.00	318.00	6.0000	2.0000	1.0000	3.0000	4.0000	5519.0	8.0000
1035.0	69.000	9.0000	3525.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	37131	8.0000
1036.0	71.000	5.0000	3950.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	7579.0	8.0000
1037.0	71.000	9.0000	3680.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	12927	8.0000
1038.0	69.000	4.0000	4173.0	340.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	24888	8.0000
1039.0	69.000	9.0000	4153.0	270.00	390.00	7.0000	2.0000	1.0000	3.0000	4.0000	36241	8.0000
1041.0	70.000	11.000	3306.0	210.00	304.00	7.0000	2.0000	1.0000	3.0000	4.0000	20398	8.0000
1042.0	70.000	1.0000	4817.0	350.00	455.00	6.0000	4.0000	1.0000	3.0000	4.0000	32431	8.0000
1044.0	69.000	5.0000	4444.0	265.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	33725	8.0000
1047.0	70.000	11.000	3904.0	245.00	360.00	7.0000	2.0000	1.0000	3.0000	4.0000	39892	8.0000
1048.0	69.000	5.0000	4185.0	350.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	23783	8.0000
1049.0	69.000	12.000	2108.0	65.000	97.000	4.0000	1.0000	0.	3.0000	1.0000	32143	4.0000
1050.0	69.000	9.0000	4153.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	66724	8.0000
1051.0	70.000	5.0000	4542.0	265.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	13514	8.0000
1052.0	70.000	1.0000	4469.0	230.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	21331	8.0000
1053.0	68.000	6.0000	4375.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	1.0000	36563	8.0000
1054.0	71.000	8.0000	2303.0	57.000	91.000	7.0000	1.0000	1.0000	3.0000	4.0000	1178.0	4.0000
1055.0	69.000	7.0000	3185.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	16938	6.0000
1056.0	70.000	8.0000	3270.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	10808	6.0000
1057.0	69.000	12.000	2410.0	65.000	97.000	7.0000	-0.	0.	3.0000	1.0000	29623	4.0000
1058.0	69.000	3.0000	4100.0	255.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	28174	8.0000
1059.0	71.000	6.0000	4724.0	335.00	440.00	2.0000	4.0000	1.0000	3.0000	4.0000	13566	8.0000
1061.0	68.000	5.0000	3777.0	265.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	10026	8.0000
1062.0	70.000	3.0000	4188.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	46824	8.0000
1066.0	69.000	3.0000	4160.0	235.00	327.00	6.0000	2.0000	1.0000	3.0000	4.0000	31781	8.0000
1069.0	68.000	9.0000	3805.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	46183	8.0000
1070.0	68.000	3.0000	3405.0	210.00	327.00	6.0000	2.0000	1.0000	3.0000	4.0000	44688	8.0000
1071.0	69.000	13.000	4418.0	280.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	24387	8.0000
1072.0	69.000	3.0000	3565.0	255.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	39367	8.0000
1074.0	71.000	3.0000	4946.0	255.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	4879.0	8.0000
1076.0	69.000	3.0000	4100.0	235.00	327.00	6.0000	2.0000	1.0000	3.0000	4.0000	44417	8.0000
1078.0	69.000	3.0000	4715.0	265.00	396.00	6.0000	2.0000	1.0000	3.0000	4.0000	33700	8.0000
1080.0	70.000	3.0000	4188.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	15842	8.0000
1081.0	68.000	5.0000	3596.0	175.00	250.00	6.0000	1.0000	1.0000	3.0000	4.0000	84297	6.0000
1082.0	68.000	5.0000	3777.0	265.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	37023	8.0000
1083.0	69.000	9.0000	3525.0	210.00	302.00	7.0000	2.0000	1.0000	3.0000	4.0000	18731	8.0000
1084.0	69.000	3.0000	3565.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	34361	8.0000
1086.0	70.000	3.0000	3466.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	24405	8.0000
1088.0	71.000	7.0000	4275.0	335.00	440.00	2.0000	4.0000	1.0000	3.0000	4.0000	10095	8.0000
1089.0	71.000	9.0000	2778.0	145.00	250.00	2.0000	1.0000	1.0000	3.0000	4.0000	2239.0	6.0000
1091.0	69.000	8.0000	4105.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	37417	8.0000
1092.0	70.000	9.0000	2778.0	120.00	200.00	2.0000	1.0000	1.0000	3.0000	4.0000	20834	6.0000
1093.0	70.000	7.0000	3315.0	145.00	225.00	1.0000	1.0000	1.0000	3.0000	4.0000	24291	6.0000
1097.0	68.000	7.0000	3700.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	29741	8.0000
1100.0	69.000	13.000	3443.0	280.00	343.00	2.0000	4.0000	1.0000	3.0000	4.0000	44726	8.0000
1103.0	68.000	9.0000	4153.0	315.00	390.00	3.0000	4.0000	1.0000	3.0000	4.0000	39102	8.0000
1105.0	68.000	3.0000	3300.0	140.00	230.00	6.0000	1.0000	0.	3.0000	4.0000	54128	6.0000
1106.0	70.000	9.0000	4122.0	250.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	24847	8.0000
1109.0	71.000	9.0000	2315.0	100.00	97.000	3.0000	2.0000	0.	3.0000	4.0000	3339.0	4.0000
1113.0	70.000	9.0000	4091.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	12760	8.0000
1117.0	68.000	3.0000	4005.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	24373	8.0000

TABLE 1
SUMMARY OF TEST DATA

FLEET 2 DETROIT

TABULATION OF CAL PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
1118.0	68.000	5.0000	4504.0	340.00	400.00	6.0000	4.0000	1.0000	3.0000	4.0000	41418	8.0000
1119.0	68.000	8.0000	4080.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	31174	8.0000
1120.0	70.000	7.0000	4290.0	230.00	318.00	2.0000	2.0000	1.0000	3.0000	4.0000	10966	8.0000
1121.0	71.000	3.0000	3492.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	2828.0	8.0000
1122.0	70.000	8.0000	4145.0	290.00	383.00	1.0000	2.0000	1.0000	3.0000	4.0000	19904	8.0000
1123.0	70.000	3.0000	4633.0	265.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	23318	8.0000
1127.0	70.000	3.0000	4188.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	37658	8.0000
1129.0	69.000	2.0000	5219.0	375.00	472.00	6.0000	4.0000	1.0000	3.0000	4.0000	23534	8.0000
1130.0	69.000	12.000	2108.0	55.000	91.100	4.0000	1.0000	0.	3.0000	3.0000	25238	4.0000
1131.0	69.000	9.0000	3365.0	120.00	200.00	7.0000	1.0000	1.0000	3.0000	3.0000	6983.0	6.0000
1132.0	70.000	3.0000	4188.0	300.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	30609	8.0000
1139.0	69.000	6.0000	4465.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	21334	8.0000
1141.0	69.000	1.0000	3919.0	230.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	25953	8.0000
1148.0	71.000	5.0000	2550.0	90.000	140.00	6.0000	1.0000	1.0000	3.0000	4.0000	3970.0	4.0000
1151.0	70.000	4.0000	3398.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	18615	8.0000
1153.0	69.000	4.0000	4304.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	49281	8.0000
1154.0	69.000	6.0000	4690.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	3.0000	47521	8.0000
1160.0	68.000	3.0000	4005.0	275.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	51885	8.0000
1161.0	70.000	6.0000	4565.0	290.00	383.00	2.0000	2.0000	1.0000	3.0000	4.0000	57088	8.0000
1163.0	70.000	4.0000	4378.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	26074	8.0000
1168.0	68.000	12.000	2108.0	65.000	96.600	4.0000	1.0000	0.	3.0000	3.0000	56153	4.0000
1169.0	71.000	1.0000	4507.0	230.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	4519.0	8.0000
1171.0	70.000	12.000	2527.0	65.000	96.600	7.0000	-0.	0.	3.0000	3.0000	19542	4.0000
1172.0	68.000	2.0000	5186.0	375.00	472.00	6.0000	4.0000	1.0000	2.0000	1.0000	58378	8.0000
1174.0	69.000	4.0000	4964.0	310.00	455.00	6.0000	2.0000	1.0000	3.0000	4.0000	57665	8.0000
1175.0	68.000	1.0000	4005.0	250.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	39876	8.0000
1176.0	71.000	4.0000	4436.0	250.00	351.00	3.0000	2.0000	1.0000	3.0000	4.0000	17705	8.0000
1177.0	71.000	9.0000	2315.0	75.000	97.600	3.0000	1.0000	0.	3.0000	4.0000	13323	4.0000
1178.0	71.000	12.000	2108.0	65.000	96.600	4.0000	1.0000	0.	3.0000	3.0000	475.00	4.0000
1181.0	68.000	4.0000	4463.0	290.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	39172	8.0000
1182.0	71.000	5.0000	3972.0	265.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	14405	8.0000
1183.0	68.000	1.0000	4365.0	230.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	58343	8.0000
1185.0	71.000	3.0000	2550.0	90.000	140.00	6.0000	1.0000	1.0000	3.0000	4.0000	992.00	4.0000
1186.0	70.000	4.0000	3672.0	310.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	25166	8.0000
1188.0	69.000	6.0000	3385.0	190.00	273.00	2.0000	2.0000	1.0000	3.0000	4.0000	46685	8.0000
1191.0	68.000	4.0000	3789.0	310.00	350.00	6.0000	4.0000	1.0000	3.0000	4.0000	50097	8.0000
1192.0	69.000	9.0000	3135.0	120.00	200.00	3.0000	1.0000	1.0000	3.0000	4.0000	15856	6.0000
1193.0	71.000	12.000	2107.0	65.000	96.600	4.0000	1.0000	0.	3.0000	3.0000	15384	4.0000
1194.0	68.000	4.0000	4363.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	56000	8.0000
1195.0	70.000	5.0000	3834.0	225.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	20172	8.0000
1196.0	71.000	10.000	2924.0	115.00	200.00	2.0000	1.0000	1.0000	3.0000	4.0000	7475.0	6.0000
1197.0	71.000	4.0000	3872.0	240.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	6928.0	8.0000
1198.0	68.000	3.0000	4005.0	250.00	327.00	6.0000	4.0000	1.0000	3.0000	4.0000	73103	8.0000
1199.0	69.000	3.0000	3320.0	140.00	230.00	6.0000	1.0000	1.0000	3.0000	4.0000	35455	6.0000
1201.0	69.000	8.0000	3845.0	330.00	383.00	2.0000	4.0000	1.0000	3.0000	3.0000	52345	8.0000
1202.0	68.000	9.0000	4001.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	53689	8.0000
1203.0	70.000	3.0000	3578.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	8840.0	8.0000
1205.0	71.000	10.000	4787.0	320.00	429.00	3.0000	2.0000	1.0000	3.0000	4.0000	3687.0	8.0000
1207.0	69.000	3.0000	3323.0	140.00	230.00	6.0000	1.0000	1.0000	3.0000	4.0000	26930	6.0000
1211.0	71.000	8.0000	4275.0	300.00	383.00	2.0000	4.0000	1.0000	3.0000	1.0000	4218.0	8.0000
1212.0	70.000	9.0000	3600.0	220.00	302.00	3.0000	2.0000	1.0000	3.0000	4.0000	25728	8.0000
1215.0	71.000	4.0000	4404.0	240.00	351.00	3.0000	2.0000	1.0000	3.0000	1.0000	20858	8.0000
1217.0	70.000	3.0000	3736.0	250.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	16814	8.0000
1221.0	70.000	9.0000	4091.0	250.00	351.00	3.0000	2.0000	1.0000	3.0000	1.0000	23148	8.0000
1222.0	68.000	10.000	3615.0	210.00	302.00	3.0000	2.0000	1.0000	3.0000	1.0000	35062	8.0000
1224.0	68.000	1.0000	3797.0	280.00	350.00	6.0000	4.0000	1.0000	3.0000	1.0000	38213	8.0000
1225.0	70.000	8.0000	3940.0	330.00	383.00	1.0000	4.0000	1.0000	3.0000	1.0000	7666.0	8.0000
1229.0	71.000	3.0000	3492.0	245.00	350.00	6.0000	2.0000	1.0000	3.0000	4.0000	3134.0	8.0000
1231.0	68.000	9.0000	3743.0	200.00	289.30	3.0000	2.0000	1.0000	3.0000	4.0000	38761	8.0000
1232.0	70.000	2.0000	5089.0	375.00	472.00	6.0000	4.0000	1.0300	3.0000	4.0000	27624	8.0000
1237.0	68.000	12.000	2218.0	65.000	97.000	4.0000	1.0000	0.	3.0000	3.0000	51596	4.0000
1254.0	71.000	3.0000	4140.0	200.00	307.00	6.0000	2.0000	1.0000	3.0000	4.0000	13765	8.0000
1257.0	70.000	5.0000	4471.0	265.00	400.00	6.0000	2.0000	1.0000	3.0000	4.0000	17253	8.0000

FLEET 2 DETROIT

TABULATION OF CAL PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE

CAR NO	YEAR	CAR MAKE	WEIGHT	HORSEPOWER	ENG DISPL	CARB MAKE	CARB BBLS	TRANS TYPE	EXHAUST	CRANKCASE	MILEAGE	CYLINDERS
ESTIMATE OF MEAN			3800.7	226.63	315.02	4.7132	2.2047	.89922	2.9612	3.6977	27863	7.3488
ESTIMATE OF STANDARD DEVIATION			698.96	76.955	92.107	1.9772	.99674	.30220	.29056	.82542	17340	1.3029
DEGREES OF FREEDOM			128	128	128	128	128	128	128	128	128	128
T VALUE			61.757	33.448	38.846	27.074	24.977	33.796	115.75	50.880	18.250	64.060

TABLE 1
SUMMARY OF TEST DATA

TRW SYSTEMS

TABULATION OF CRC PARAMETER DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0. INDICATES MISSING DATA) RUN DATE DETERIORATION DATA (-0.

CAR NO	TEST NO	CAR MAKE	IG TIMG MS	IG TIMG DV	PT DWEL MS	PT DWEL DV	SPARK LINE	MISFIRE D1	MISFIRE D2	MISFIRE D3	RQ VOLT MS/ COIL AV MS	RQ VOLT D1/ COIL AV MS	RQ VOLT D2/ COIL AV MS	RQ VOLT D3/ COIL AV MS
1118.0	1.1000	5.0000	6.0000	-3.0000	32.000	0.	0.	0.	0.	0.	.34483	.47414	.43966	.43103
1119.0	1.1000	8.0000	0.	-7.5000	21.000	-7.0000	0.	0.	0.	0.	.31481	.34259	.35185	.43519
1120.0	1.1000	7.0000	0.	0.	35.000	1.0000	0.	0.	0.	0.	.24342	.26316	.23026	.36842
1121.0	1.1000	3.0000	9.0000	1.0000	29.000	0.	0.	0.	0.	0.	.25758	.22727	.28788	.34091
1122.0	1.1000	8.0000	4.0000	1.5000	35.000	2.5000	0.	0.	0.	0.	.21429	.25786	.33036	.39286
1123.0	1.1000	3.0000	14.000	6.0000	29.000	0.	0.	0.	0.	0.	.23438	.33594	.33594	.29688
1127.0	1.1000	3.0000	10.000	6.0000	26.000	-2.0000	0.	0.	0.	0.	.30000	.41667	.36667	.38333
1129.0	1.1000	2.0000	7.0000	2.0000	44.000	12.000	0.	0.	0.	0.	.23333	.28333	.25833	.28333
1130.0	1.1000	12.000	0.	0.	57.000	4.0000	0.	0.	0.	0.	.23611	.34722	.35417	.40278
1131.0	1.1000	9.0000	9.0000	3.0000	40.000	0.	0.	0.	0.	0.	.19278	.19444	.17361	.18056
1132.0	1.1000	3.0000	0.	-4.0000	31.000	0.	0.	0.	0.	0.	.33824	.26471	.24265	.29412
1139.0	1.1000	6.0000	6.0000	-1.5000	29.000	-1.0000	0.	0.	0.	0.	.26389	.33333	.34722	.38889
1141.0	1.1000	1.0000	10.000	4.0000	27.000	-2.0000	0.	0.	0.	0.	.37500	.37500	.38281	.37500
1148.0	1.1000	3.0000	7.0000	1.0000	31.000	0.	0.	0.	0.	0.	.27344	.27344	.28125	.28125
1151.0	1.1000	9.0000	3.0000	-3.0000	32.000	3.0000	0.	0.	0.	0.	.29688	.21875	.27344	.35938
1153.0	1.1000	4.0000	4.0000	-2.0000	32.000	0.	0.	0.	0.	0.	.20588	.38235	.36765	.29412
1154.0	1.1000	6.0000	5.0000	-2.5000	28.000	-2.0000	0.	0.	0.	0.	.23438	.25781	.27344	.35156
1160.0	1.1000	3.0000	4.0000	0.	31.000	0.	0.	0.	0.	0.	.25735	.36765	.38235	.35294
1161.0	1.1000	6.0000	8.0000	5.5000	27.000	-1.5000	0.	0.	0.	0.	.34848	.34848	.36364	.37879
1163.0	1.1000	4.0000	11.000	3.0000	29.000	0.	0.	0.	0.	0.	.27344	.29688	.31250	.32813
1168.0	1.1000	12.000	2.0000	2.0000	50.000	0.	0.	0.	0.	0.	.30556	.29167	.29861	.38889
1169.0	1.1000	1.0000	7.0000	3.0000	28.000	-1.0000	0.	0.	0.	0.	.33333	.35000	.35000	.40000
1171.0	1.1000	12.000	0.	0.	45.000	-2.0000	0.	0.	0.	0.	.26471	.22059	.29412	.36765
1172.0	1.1000	2.0000	14.000	9.0000	21.000	-9.0000	0.	0.	0.	0.	.30000	.30000	.28333	.35000
1174.0	1.1000	4.0000	9.0000	3.0000	27.000	-1.0000	0.	0.	0.	0.	.21875	.25000	.25781	.29688
1175.0	1.1000	3.0000	7.0000	3.0000	30.000	0.	0.	0.	0.	0.	.22857	.24286	.22857	.27143
1176.0	1.1000	9.0000	4.0000	-2.0000	35.000	4.0000	0.	0.	0.	0.	.33784	.39189	.35135	.35135
1177.0	1.1000	9.0000	6.0000	-6.0000	44.000	4.0000	0.	0.	0.	0.	.35185	.27778	.32407	.39815
1178.0	1.1000	12.000	0.	5.0000	49.000	0.	0.	0.	0.	0.	.23684	.27632	.32237	.31579
1181.0	1.1000	4.0000	6.0000	1.0000	30.000	0.	0.	0.	0.	0.	.15833	.19167	.20000	.23333
1182.0	1.1000	5.0000	11.000	3.0000	28.500	0.	0.	0.	0.	0.	.30833	.22500	.26667	.30000
1183.0	1.1000	1.0000	7.0000	7.0000	28.000	-1.0000	0.	0.	0.	0.	.24219	.23438	.21875	.25781
1185.0	1.1000	3.0000	9.0000	3.0000	26.000	-5.0000	0.	0.	0.	0.	.26563	.28906	.31250	.31250
1186.0	1.1000	4.0000	6.0000	-4.0000	31.500	0.	0.	0.	0.	0.	.27941	.30882	.29412	.30882
1188.0	1.1000	8.0000	0.	2.5000	28.000	-2.0000	0.	0.	0.	0.	.23438	.21875	.22656	.33594
1191.0	1.1000	4.0000	7.0000	-.50000	29.000	0.	0.	0.	0.	0.	.26471	.27941	.29412	.30882
1192.0	1.1000	9.0000	9.0000	3.0000	45.000	5.0000	0.	0.	0.	0.	.18056	.23611	.18750	.30556
1193.0	1.1000	12.000	0.	5.0000	53.000	0.	0.	0.	0.	0.	.35938	.25000	.30469	.35938
1194.0	1.1000	4.0000	-0.	-0.	31.000	0.	0.	0.	0.	0.	.25758	.43939	.34848	.33333
1195.0	1.1000	5.0000	8.0000	-1.0000	29.000	0.	0.	0.	0.	0.	.31250	.31250	.35938	.32031
1196.0	1.1000	10.000	9.0000	3.0000	38.000	0.	0.	0.	0.	0.	.22059	.25735	.20588	.29412
1197.0	1.1000	4.0000	13.000	3.0000	31.500	0.	0.	0.	0.	0.	.25714	.25714	.22857	.34286
1198.0	1.1000	3.0000	2.0000	-2.0000	31.000	0.	0.	0.	0.	0.	.26385	.25694	.29167	.30556
1199.0	1.1000	3.0000	-0.	-0.	32.000	0.	0.	0.	0.	0.	.21875	.26563	.30469	.31250
1201.0	1.1000	8.0000	2.0000	-3.0000	28.000	-2.0000	1.0000	5.0000	6.5000	3.5000	.26786	.25000	.25893	.41071
1202.0	1.1000	9.0000	10.000	4.0000	31.000	0.	0.	0.	0.	0.	.16216	.24324	.22973	.24324
1203.0	1.1000	3.0000	7.0000	-1.0000	31.000	0.	0.	0.	0.	0.	.30556	.29861	.29861	.31944
1205.0	1.1000	10.000	7.0000	3.0000	30.000	1.0000	0.	0.	0.	0.	.23529	.30147	.26471	.30147
1207.0	1.1000	3.0000	5.0000	1.0000	30.000	-1.0000	0.	0.	0.	0.	.15132	.27632	.22368	.27632
1211.0	1.1000	8.0000	3.0000	.50000	30.000	0.	0.	0.	0.	0.	.24107	.30357	.32143	.46429
1212.0	1.1000	9.0000	5.0000	-1.0000	27.000	0.	0.	0.	0.	0.	.29412	.26471	.32353	.32353
1215.0	1.1000	9.0000	11.000	5.0000	32.000	3.0000	0.	0.	0.	0.	.23529	.33824	.30882	.41176
1217.0	1.1000	3.0000	7.0000	3.0000	30.000	0.	0.	0.	0.	0.	.23485	.28788	.26515	.29545
1221.0	1.1000	9.0000	2.0000	-4.0000	28.000	0.	0.	0.	0.	0.	.27778	.40278	.34722	.31944
1222.0	1.1000	10.000	5.0000	-1.0000	45.000	18.000	0.	0.	0.	0.	.30882	.33824	.32353	.36765
1224.0	1.1000	1.0000	4.0000	4.0000	45.000	15.000	0.	0.	0.	0.	.26471	.26471	.25000	.28676
1225.0	1.1000	8.0000	11.000	8.5000	26.000	-2.5000	0.	0.	0.	0.	.16667	.19697	.26515	.28788
1229.0	1.1000	3.0000	7.0000	1.0000	29.000	0.	0.	0.	0.	0.	.30303	.31061	.30303	.31061
1231.0	1.1000	9.0000	-0.	-0.	35.000	6.0000	0.	0.	0.	0.	.26471	.32353	.30882	.30882
1232.0	1.1000	2.0000	3.0000	-4.5000	30.000	0.	0.	0.	0.	0.	.29688	.31250	.24219	.33594
1237.0	1.1000	12.000	0.	0.	59.000	8.0000	0.	0.	0.	0.	.21429	.32143	.34821	.37500
1254.0	1.1000	3.0000	5.0000	-3.0000	37.000	1.0000	0.	0.	0.	0.	.21528	.25000	.30556	.31250
1257.0	1.1000	5.0000	8.0000	-1.0000	32.000	0.	0.	0.	0.	0.	.37697	.36290	.33871	.41935